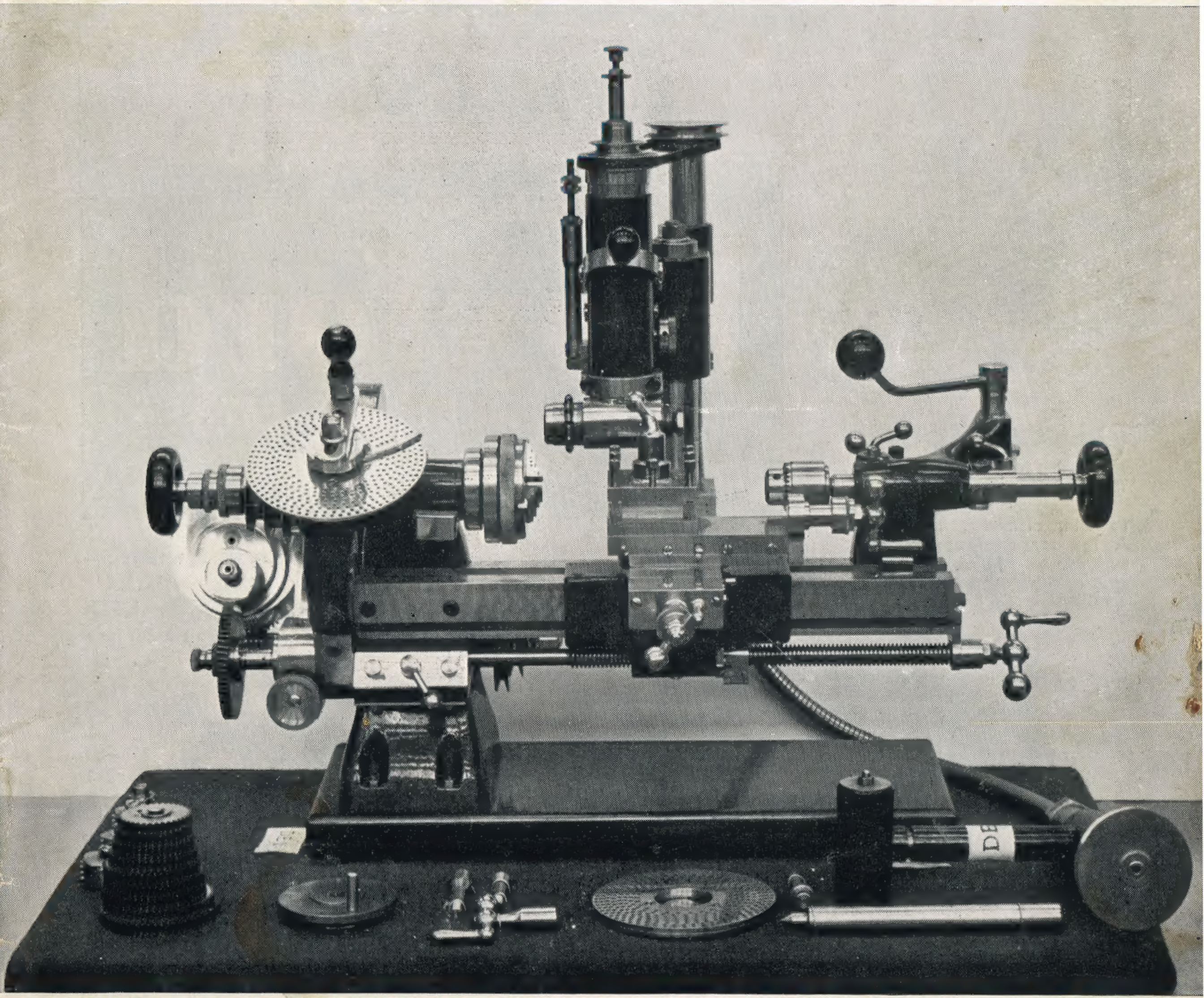
THE MODEL ENGINEER



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APRIL 21st 1955
Vol. 112 No. 2813

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THE
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OUR COVER PICTURE

The 2 in. precision lathe shown in this photograph was constructed by Messrs. W. Fowkes and R. Turner, of Matlock, and exhibited at the 1951 "M.E." Exhibition, where it was awarded a Silver Medal, also in the competition for the Duke of Edinburgh Cup in the 1954 Exhibition. Apart from being an excellent example of workmanship, this lathe merits special distinction for the ingenuity of its design and its complete equipment, which includes indexing gear to the headstock, lever feed tailstock, and milling attachment with vertical and horizontal spindles.

"M.E." Exhibition Novelty

AT THIS year's "M.E." Exhibition there will be an innovation in that an Exhibition of Inventions, sponsored by the Institute of Patentees, will be held in the Lecture Room at the New Horticultural Hall. Thus, there will be two exhibitions in one, and our visitors, large numbers of whom are interested in inventions of most kinds, will have the opportunity of seeing a comprehensive selection. We hope to publish some further details about these particular exhibits very shortly.

Co-operation Requested

THE ILFORD and West Essex Model Railway Club has its 7¼-in. gauge London and South Western Urie 4-6-0 locomotive running again. It is a powerful engine which has proved itself to be very useful at fêtes, gala days and other functions where a passenger-hauling steam locomotive is a popular attraction. While the club has no track or rolling-stock, it would be very pleased to co-operate with other clubs or organisations who have the quipment, for fêtes and other functions. Anyone interested is invited to write to Mr. R. L. Riddle, 36, Vernon Road, Seven Kings, Essex.

Centenary of Aluminium

THE ALUMINIUM DEVELOPMENT ASSOCIATION announces that, on June 1st to 11th, at the Royal Festival Hall, London, the aluminium industry is to present a Progress Exhibition, not only to mark the centenary of aluminium as a commercial metal, but to demonstrate, convincingly, how the present vast output and unique experience already gained are now being applied to every great industry in increasing measure.

At the Paris Exposition in 1855, the French scientist, Professor St. Claire Deville, exhibited samples of the metal which, at that time, was rated a precious metal, as it cost £60 per pound to produce! Deville had succeeded in extracting the metal from clay, by means of a chemical process; about thirty years later, the electrolitic process of extracting aluminium from its oxide was patented. Today, using basically that same method of extraction, 30,000 tons of pure aluminium are produced in Britain alone, at the great hydro-electric plant in the Scottish Highlands. From £144,000 per ton the price is now £165 per ton. The great progress made, during the last ten years, of the application of this metal and its alloys to every kind of industry is only a beginning, which the forthcoming exhibition should make clear.

S.D.J.R. "Cut-down" Locos

WE HAVE received some information in reply to Mr. Haydon D. Smith's letter published in our February 24th issue, and we thank the readers concerned for their interest.

In the years 1895 and 1897, two 0-4-2 saddle tanks were built, at Highbridge works, having a height of about 10 ft. in order to work into a colliery at Radstock. The dimensions were: Cylinders 11 in. diameter by 14 in. stroke. Coupled wheels 3 ft. 6 in., trailing 2 ft. 2 in. Total wheelbase 9 ft. 10 in. Boiler 2 ft. 7 in. diameter by 7 ft. 6 in. long. Boiler centre height above rail 4 ft. 11½ in. Grate area 5 sq. ft.; boiler pressure 150 p.s.i. Weight in W.O. 20 ton 12 cwt. 2 qt. Tractive effort at 80 per cent. 4,840 pounds. These engines were built by Mr. Ryan, and it will be seen that the figure of overall height of 4 ft. or so, as given by Mr. Smith, is far too low. Stephen Lewin of the Dorset Iron Foundry Poole built some engines to work into a heading at the Laxey Mines I.O.M. in 1878 which were only 4 ft. high, but for a 19-in. gauge.

A very similar type of engine was that used at Reynoldstown Colliery, in South Wales, built by Kerr Stuart which was 6 ft. high, this was an 0-4-0 and was for 4 ft. gauge.

Andrew Barclay of Kilmarnock built a type of locomotive in which the cab and chimney could be lowered with this object in view.

A photograph of a locomotive of this type can be found in "Narrow Gauge Rails in Mid Wales," by J. I. C. Boyd. A good many photographs and descriptions of locomotives of this kind have in the past been published in *Engineering* and *The Locomotive*.

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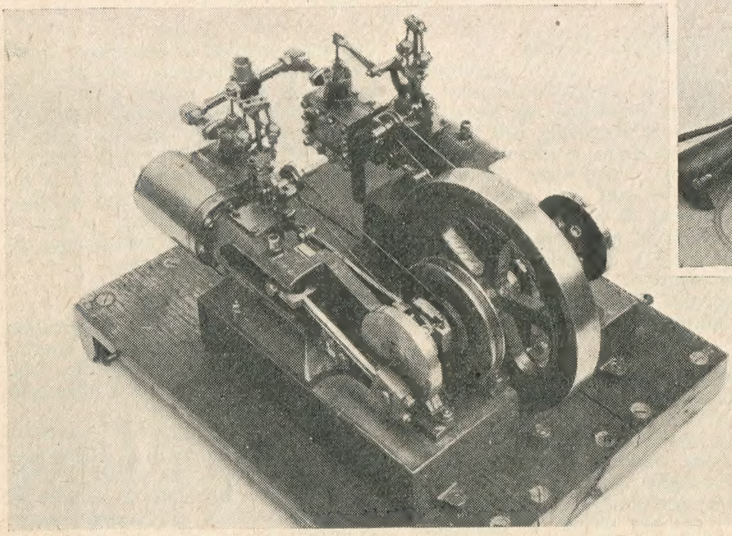
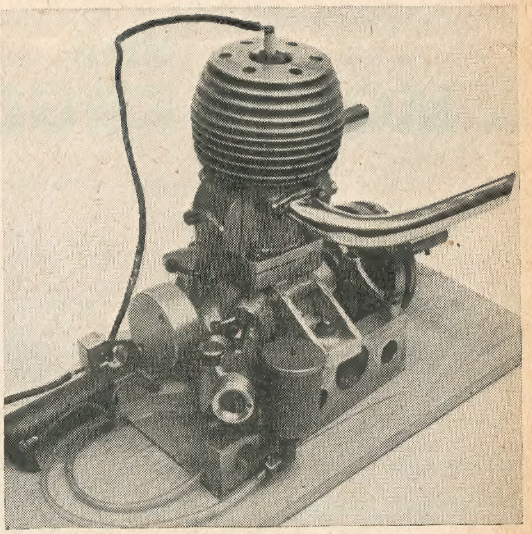
THE NORTHERN MODELS EXHIBITION

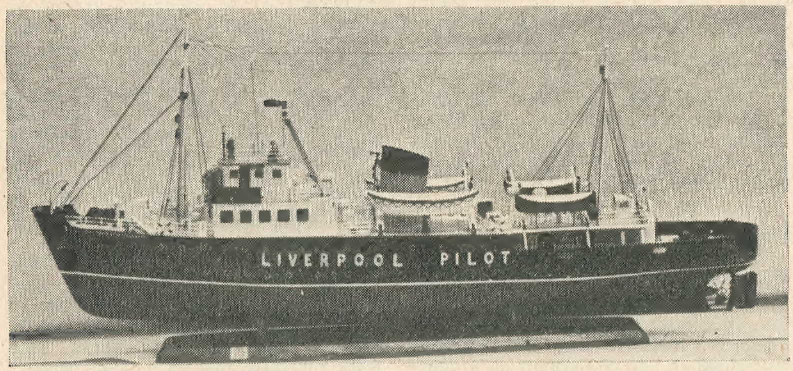
Reported by "Northerner"



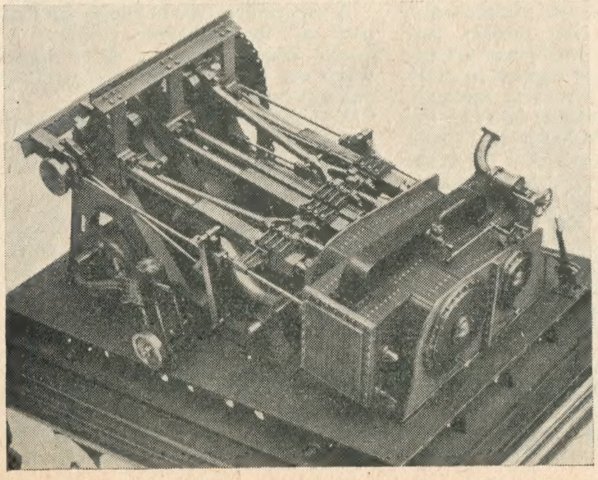


A popular Westbury design is the 30 c.c. Atom V petrol engine. The example now shown was built by H. Davies of Rochdale

Left: An example of the twin Tangye engine described by E. T. Westbury, built by Rochdale club-members at last year's Manchester exhibition



W. E. Barnes of Wilmslow must have a large fleet of power-boats by now, his latest being the pilot-vessel seen here



Left: E. B. Wilcox's magnificent marine-engine model—a diagonal compound condensing paddle-engine

ONE of the things that struck me about the N.A.M.E. Exhibition at Manchester this year was the number of exhibits which owed their origin to THE MODEL ENGINEER; although, when one comes to think about it, the same can usually be said of any exhibition of models. Designs by "L.B.S.C.", by E. T. Westbury, and by "Duplex," to name but three regular contributors, are always popular, and it is to the credit of this journal that many thousands of models have been built, not a few of them by beginners, in the knowledge that they would be successful when completed. Even of the many "free-lance" models one sees, the really vital parts of the design are frequently based on or adapted from THE MODEL ENGINEER, even if the builder is sometimes reluctant to admit it!

But here am I, after a hard day at the exhibition, with this article to write before I go to bed, and another long day in store tomorrow, talking about the origin of models! Get cracking, lad, or you won't go to bed tonight!

This year's winner of the Myford Trophy, for the best model in the exhibition, was E. B. Wilcox of Weaverham, with the magnificent triple-expansion marine engine which won a Championship cup at the last London exhibition. At Manchester it was also awarded first prize, and the N.A.M.E. Trophy in its class. However, it is not proposed to deal with the model here, as it is not long since it was described and illustrated, but rather to mention other exhibits by Mr. Wilcox.

One of these was a compound diagonal paddle engine, which was beautifully made and finished, with plenty of

fine detail. As an idea of the size, the baseplate is $17\frac{1}{2}$ in. by 10 in. The model was built to Mr. Wilcox's own drawings, prepared by scaling up two engraved perspective views in an old book. It took seven years to build.

Only the A-frames and cross-head slippers are castings, the remainder of the parts being fabricated where necessary. As an example, the cylinders are made from tubing, with valve-face blocks machined to radius and silver-soldered on, the steam-ways having been milled in the radiused side first. The ends of the cylinders are screwcut 60 t.p.i., with the flanges screwed on a wringing fit, and sweated to ensure steam tightness. The crankshaft is built up, with interference fits (0.001 in. per inch), but the eccentrics are turned solid with their respective parts of the shaft. Stephenson reversing motion is fitted, with Brown's steam-hydraulic operation.

An ingenious method of making a neat exhaust pipe, which is a very shallow S-curve, was to take some scrapped cycle handle-bars and cut out suitable sections, to which bolting flanges were then brazed. Perfect curves and perfect symmetry are the result!

Making Chequer Footplates

In view of the interest shown recently in these pages on the subject of raised diamond-pattern footplates, the method used by Mr. Wilcox will not be out of place here. He cut a die, 3 in. by 2 in., by flycutting narrow grooves at equal distances diagonally across a plate, to give the diamond pattern in reverse. This was then edged with strips of metal, and molten plumbers' solder poured in, after heating the die, giving a casting about $\frac{1}{4}$ in. thick with the raised pattern on one side.

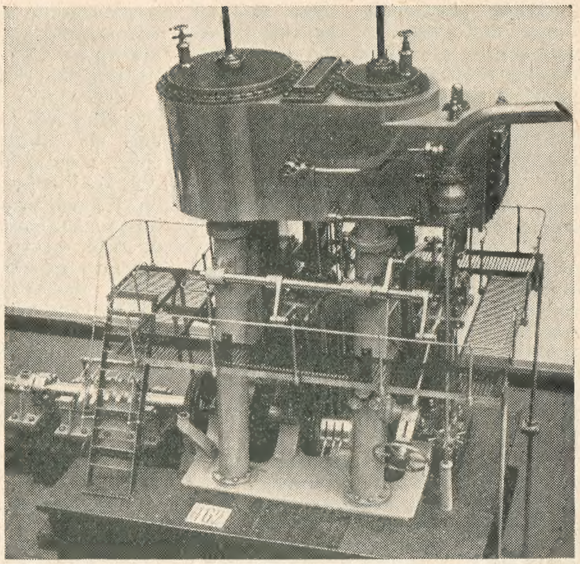
Placed centrally on the faceplate with the pattern inwards, and held up to it by the tailstock centre, the surplus is then faced off, to leave the plate $\frac{1}{16}$ in. thick. These plates look most realistic, and I commend the method very heartily; in my opinion it beats the method of using a single punch, because of the perfect regularity of the marking.

This model, by the way, won the Stevens Cup in London in 1948, and other exhibits by Mr. Wilcox were a Silver Medal winner of 1935, and a Bronze winner of 1948, these both being compound vertical marine engines.

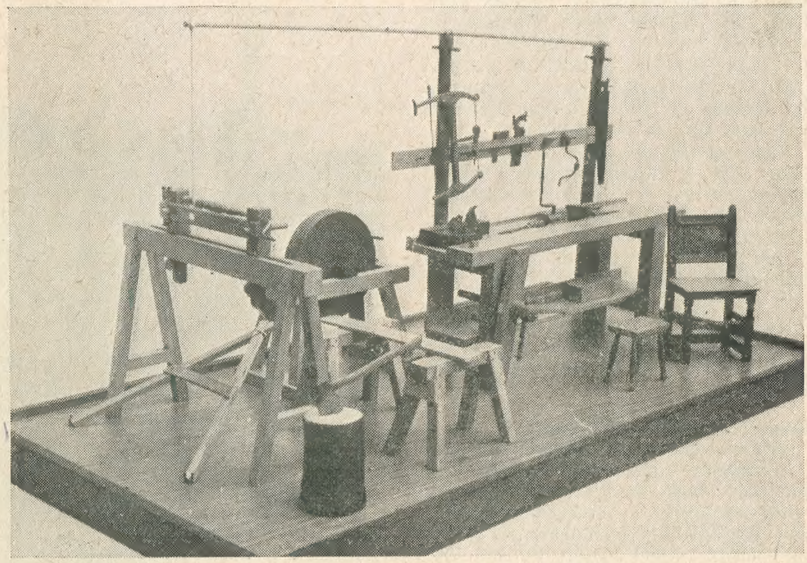
A Rebuilt Old-timer

A. Nuttall of Rochdale exhibited an interesting inverted vertical steam-engine, which he had rebuilt from a model believed to be about sixty years old. The original makers are unknown, but Mr. Nuttall told me that the quality of the craftsmanship varied considerably, which seems to indicate that at least two people partook in the construction. The model was in poor condition when he acquired it, and he had to make several new parts,

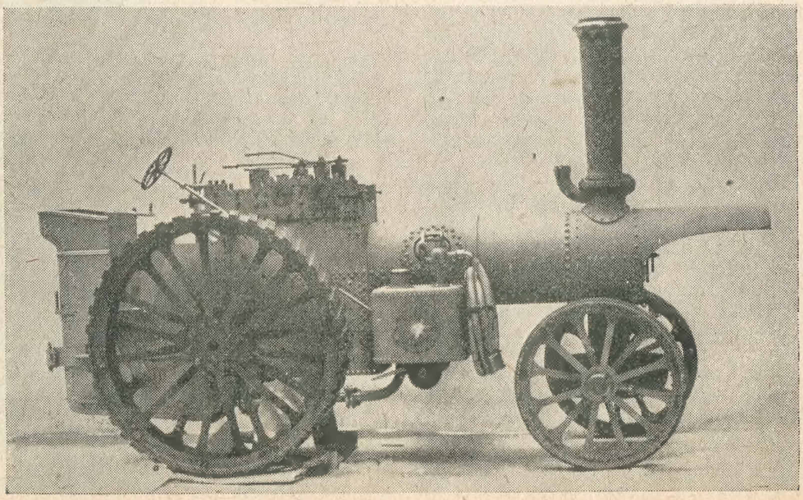
Right: A beautifully-built compound condensing marine engine by E. B. Wilcox, whose triple-expansion engine was judged best model in the exhibition



Below: One of the models shown by C. Ingham of Leyland was this old-time joiner's shop, complete with pole-lathe



Bottom: L. G. Formilli of Sale has been working nine years on this massive 3-in. scale model of a Fowler showman's engine



including crankshaft, three sets of brasses and cotters for the forked connecting-rod, slide-valve and rod, steam regulator-valve, pump, and some new parts for the governor.

The original A-frames and flywheel are very clean castings, involving some nice pattern-making, but the cylinder and valve-chest were fabricated, not cast. An unusual feature of the original design was that the engine was mounted on a solid cored cast-iron boiler of rectangular section, with three $1\frac{1}{4}$ in. diameter copper flues expanded in—not very safe at much of a working-pressure! Another interesting point is that what appear to be nuts and washers are, in fact, in one piece, being filed up from round bar. Bore and stroke are $1\frac{1}{8}$ in. by 2 in., and height to crankshaft is 12 in. approximately.

Another engine of unknown origin, and rescued from the scrap-heap, was a Uniflow steam-engine with two horizontally opposed cylinders, exhibited by F. Smith of Shawforth. Of this, only the crankcase, cylinder castings, and cylinder heads remained, in very bad condition. The inlet valves are of the poppet type, operated by a single cam on the crankshaft, and returned by springs on the rods; the flywheel was once part of an oil-pump.

Also on the stand of the Rochdale club was a double-cylinder Tangye engine to E. T. Westbury's design, which the club members had almost finished machining as a demonstration at the last Northern show. It had been finished off by E. Hobson, of Shaw, and was a handsome engine, though it bore evidence of rather hurried machining in places—perhaps inevitable in the circumstances—and the paint was rather rough.

Some Remarkable Woodwork

It is a truism that in model engineering a tradesman does not always produce the best work in his particular line—for example, a professional turner may frequently be beaten for perfection of finished turned surface by one who is *not* in the trade. This may be due to the fact that the non-professional works more slowly than the tradesman, who normally and under commercial conditions cannot afford to take his time, and therefore, becomes inured to a standard which, though adequate, falls short of absolute perfection.

However, an exception "to prove the rule" was some delightful woodwork by C. Ingham of Leyland, who is a joiner by trade. His model of an old-time joiner's shop, to a scale of $1\frac{1}{8}$ in. to a foot, was a joy to behold, and fully deserved its First Prize. The bench incorporated an old type of wooden vice, and bore a full set of planes—trying, jack, smoothing, rebate, and router—with chisels, bow-saw, tenon saw, oilstone in box, spoke-shave, and a wooden try-square with the tiniest imaginable mortise-and-tenon joint. A feature of the shop which I have not seen modelled before was a pole-lathe, with its pole supported on two standards attached to the bench, and a chair-leg between its centres.

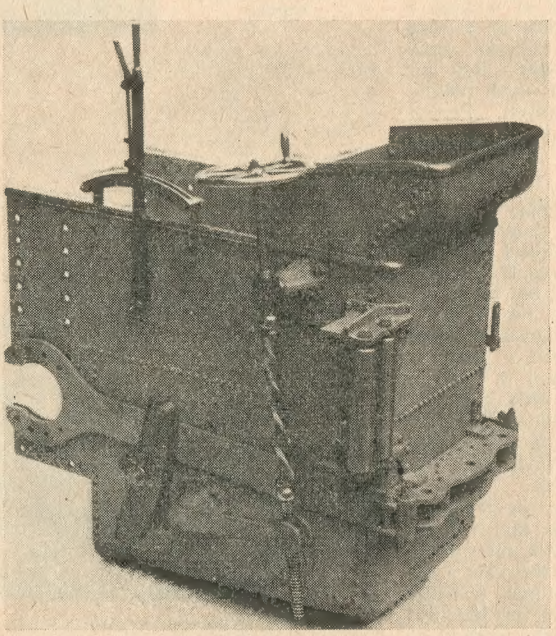
Other extremely good models by Mr. Ingham were of a 16th century oak chest and an Elizabethan box stool—the chest is about 8 in. long. The upper rails are fitted to the legs with haunched mortise-and-tenon joints, with ordinary ones for the lower rails, and the bottoms of both pieces are made from real tongued-and-grooved boards only $\frac{1}{16}$ in. thick. Well-made iron hinges are used for the lids. The centre panel of the chest is inlaid in ivory and ebony, and the rails of the stool are nicely carved. Finished in natural colour, with a wax polish, these two pieces would form an adornment to anybody's home.

H. W. Cooke's model stage-coach was also a nice piece of woodwork, though not quite in the same category as Mr. Ingham's. But there was some good fitting, with a medium glossy finish on a natural colour which was very pleasing, though not true to the painted prototype, of course. The brass fittings—lamps, hub-caps, post-horn, and so on—were also well finished, and the lamps and interior could be illuminated electrically. Again not to the prototype, but then the whole purpose of the model was decorative, which it achieved.

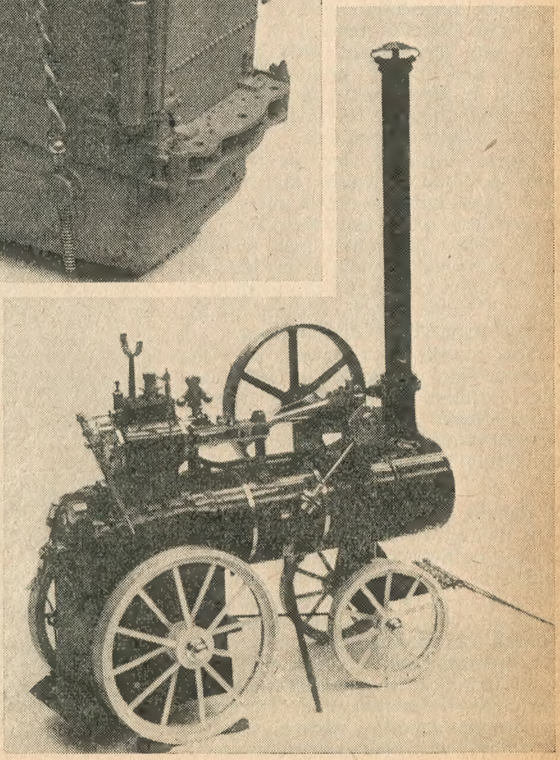
Locomotives

Most of the locomotives on show were built to the "words and music" of L.B.S.C., but the champion was the Lancashire and Yorkshire Atlantic built by E. F. Holden of Blackburn, to official drawings. I described and illustrated the engine alone in my report of last year's Northern exhibition, but now Mr. Holden has finished the tender too, and the result is lovely indeed. The judges evidently thought so too, awarding this exhibit the *Evening Chronicle* Trophy for the best locomotive, the N.A.M.E. Trophy for the best model by a member, and, automatically, First Prize in its class.

The tender is as well made and finished as the engine, with smooth paint, neat lettering, and



The tender of L. G. Formilli's showman's engine was, like the rest of the model, practically perfect as to detail



Right: This handsome little steam portable-engine, built by L. Gordon and E. Yates, was painted maroon, with primrose wheels

very fine lining. It has full elliptical leaf springs to the axleboxes, and full brake-gear. As a tribute to the whole model, incidentally, I have it on the authority of fellow-members of the club that "it *really goes* as well—it's terrific!" And what more can one desire in a small locomotive than perfect appearance and perfect performance, too?

Another model on the Blackburn Club's stand, which looks like being a winner, was the $3\frac{1}{2}$-in. gauge ex L.M.S. Class 5 4-6-0 being built by F. Holdsworthy. Only in the chassis stage at present, the workmanship is good and the finish excellent. I was told that this engine, by the way, is being built partly to "L.B.S.C." and partly to official L.M.S.

An "O"-gauge live-steamer, with solid-fuel firing, is not a common sight, but one is being built by H. Bonser. It is of American design—a Hudson 4-6-4—with bar-frames and sprung driving-wheels. The boiler is partly made, the firebox having a large combustion chamber with four water-tube stays, and six flues including one superheater flue.

An Imposing Model

From the point of view of sheer size, the most imposing model in the exhibition was a 3-in. scale Fowler showman's road locomotive which is being built by L. G. Formilli, of Sale. Moreover, on close inspection, this model proved to be worthy of the term "stupendous," as used by cinematic moguls to describe a film which they believe—and want the public to believe—to be really super. True, the film does not always live up to its description—but this model does. It is a very fine piece of work indeed, but since our mutual friend W. J. Hughes intends (with editorial permission) to refer to it shortly, let us say no more here, except to look forward to its completion.

Two fellows from Ashton-under-Lyne, L. Gordon and E. Yates, exhibited a single-cylinder portable engine which was awarded a Third Prize. This engine was nicely finished mechanically, and the paintwork was good on the whole, but a trifle "bitty" here and there. It looked well with maroon boiler and firebox, black smokebox and chimney, and primrose wheels. Commercial castings and drawings were used, but the latter were deficient so far as the fore-carriage was concerned, unfortunately. Enquiries were made, and the neighbourhood was searched, for a prototype, but without result, and eventually a fore-carriage was achieved which, quite by accident, looks rather like Marshall practice, with its sheet-metal apron.

Petrol Engines

Many of the petrol engines seen were, as was to be expected, made to Westbury designs, and two of them, from the Rochdale Club, were his 30 c.c. Atom V, which I have always thought to be very handsome, personally. The one by T. Brooks, however, looked infinitely better than that built by H. Davies, for, whereas the former had nicely smoothed off his castings, the latter had left them as received from the foundry, except of course where they were machined.

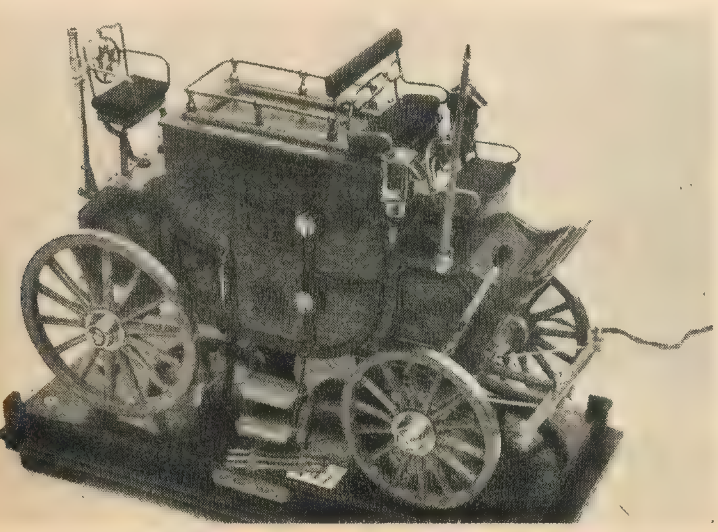
Mr. Brooks had also fabricated his carburettor, which, although more trouble than using castings, looked very much neater. A very nice finish had been achieved on the carburettor by painting it with Fryolux solder paint, heating until it melted, and finally polishing the "tinning" with metal polish. This model is to be fitted with a magneto, and with a pair of silencers, to complete it.

Junior Work

An encouraging feature of the show was the large number of entries in the Junior class, some of the models being quite elaborate. As one would expect, quality varied enormously, but much of the work showed promise, especially if the builders will acquire more patience in obtaining a good finish. But then, that is where many of their elders fall down!

Winner of the Lawton Trophy was Albert Wilson of Burnley. He is a member of the Towneley Model Club, which I described in THE MODEL ENGINEER last year after visiting Burnley, and his model police launch was built under the direction of the leader, I presume. It was a nicely finished model on the whole, but the searchlight and horn were not up to the standard of the rest of the work. I hope Master Wilson will replace them with the better ones he is obviously capable of making.

Second Prize in the junior class was awarded to another student, T. Mepham of Flixton, for a U.S. Army covered wagon, of the Civil War period. This was 10 in. long over the canopy, well made and well detailed. The body was filled with cases, bales, and boxes, and at one side were a barrel and pick-axe, balanced by a trunk and a mattock on the other. Close at hand was another covered wagon of a slightly different type, and a stage-coach, both by young Mepham.



A pleasing and ornamental model was the stage-coach by H. W. Cooke, being built more for decoration than prototype appearance

The Fair Sex

It was very nice to see a few examples of work by ladies, and in this section the First Prize was awarded to Mrs. M. A. Williams of Sale for an outstanding piece of craftsmanship, a figure of H.M. The Queen in her Coronation robes and regalia. The robes were beautifully and faithfully represented, the ornamentation being carried out in embroidery (much of it in gold thread), fabric painting, appliqué work, and hundreds of beads and jewels. The train was in purple velvet, edged with ermine, with the design embroidered in gold, and the regalia was equally well modelled. This exhibit was greatly admired by all beholders.

Miss M. Airey of Wilmslow had built a model of H.M.S. *Victory*, which was awarded a Certificate of Merit, though it must be admitted that it had several faults, principally in the choice of rigging materials. However, it was a very good effort, which must have given this lady much pleasure in building, and I hope we shall see more of her work in the future.

Finally, Mrs. I. Rowland of Urmston is building a $3\frac{1}{2}$-in. gauge *Tich*—and she could show some of the lads how to turn wheels, let me tell you. In fact, although up to now she hasn't done a lot at this engine, what she has done is of a good standard. Incidentally, I was told that Mrs. Rowland is one of the top-link drivers on the Urmston Club's track, and that she excels particularly as brewer-up-in-chief. So let's wish her all success with her *own* engine; driving that will *really* be a thrill, Mrs. Rowland!

(To be continued)

MAKING A RADIATOR

FOR MODEL I.C. ENGINE COOLING

By R. H. Mapplebeck

Photograph No. 1. End cap after shaping on its " dolly "

CIRCULATING water for engine cooling in model boats is frequently obtained from the medium on which the boat is floating for obvious reasons ; but it is sometimes advantageous to have a closed water-cooling system, because testing often has to be carried out elsewhere than on the water, and how many times has an owner wished he could run his engine with the boat on the bank in order to make some adjustment at leisure and in comfort ?

A usual routine at home may be to rig up a temporary scaffolding over the boat, and suspending from it a tin of water, or else arrange for a similar water supply to be hung from the ceiling of the workshop, whence it may be piped to the cooling water inlet and outlet of the engine.

An Untidy Business

All this makes i.c. engine testing an untidy and cumbersome business, and if the tester survives becoming entangled in the cooling feed tubes dangling all over the engine, then the chances are that when he comes to dismantle the hook-up he may unthinkingly remove the downlead tube first and receive a deluge of water all over his boat and workbench. It has been known to happen !

Other items on the balance sheet against using pond water are the possibility of blockage by weed, and corrosion by the water, especially if it is sea water, not to mention silting from particles of heaven-only-knows-what that lurk in some lakes.

With these and other points in mind, it was decided, therefore, to instal a closed water system and radiator, where pure water could be used, and the following notes supply constructional details of the radiator.

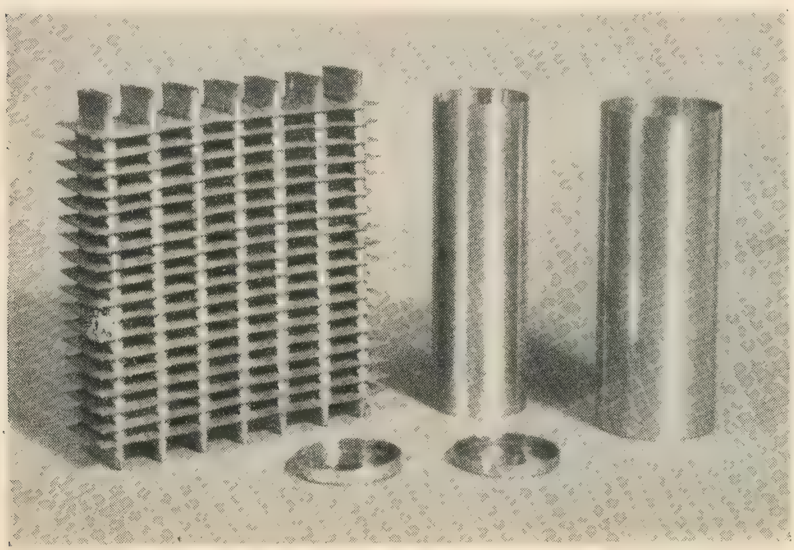
Many boats already have water pumps fitted, and in any case, their construction has been dealt with on several occasions ; so this item will be neglected at this time. Other parts required are a fan, and possibly auxiliary water tanks, which any model engineer should be able to knock up without plans and instructions, more particularly as some idea is given of the complete installation in photograph No. 3.

The Water Drums

These were made from 1¼ in. o.d. copper tube, for the top drum, and 1 in. o.d. for the lower drum. If the tubes are much thicker than 1/32 in., they may be mounted on a mandrel and skinned down to this value to reduce the weight, and then trimmed to 3½ in. length.

The end-caps were fabricated from 1/32 in. copper sheet. Two " dollies " were prepared from mild-steel rod of the respective diameters of the tubes, plus 0.002 in., and one end faced up.

Mounting these in turn in the vice, the 1/32 in. copper sheet, previously cut into discs to the diameter of the tubes, plus ¼ in., was hammered over the " dollies " to form the caps (photograph No. 1), after which they were filed up, emery-papered and polished. (Photograph No. 2.) At this stage, holes were drilled in the drums and enlarged by filing to fit the filler cap, and the inlet and outlet pipes. The tubing used for the latter was ⅜ in. o.d., which left about ¼ in. bore, whilst the filler cap was obtained from an old lighter-fuel tin. Dimensional details of the drums are given in Fig. 1.



Photograph No. 2. Assembled fins and tubes with drums and end caps

The Tubes

Approximately 2½ ft. of ½ in. o.d. annealed copper tubing, with 1/64 in. wall, was used, from which were cut seven lengths, each 4 in. long. They were squeezed flat in a vice with soft jaws, inserting a strip of metal before final compression, so as to retain an internal dimension across the flats of about 3/32 in., and impart evenness to the flattened tube shape. Fig. 2.

The Cooling Fins

Cooling fins were prepared by cutting out 18 pieces of 0.015 in. tinplate 3½ in. × 1 in. There were thus 126 oblong holes to make for the tubes, so it really paid to make up a simple jig for holding the fins whilst punching out the holes. Of course, if the fins had been all clamped together, a line of holes could have been drilled for each of the seven positions, ½ in. apart, and the individual holes finished off with small files; but this was considered tedious, and there would have been no lip to each hole to assist soldering, as there was with the punched holes. (Photograph No. 4.)

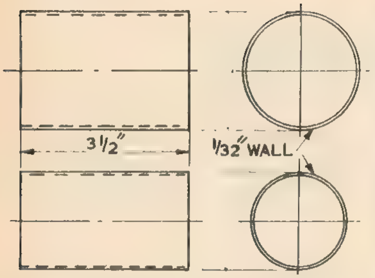


Fig. 1. Dimensions of upper and lower drums

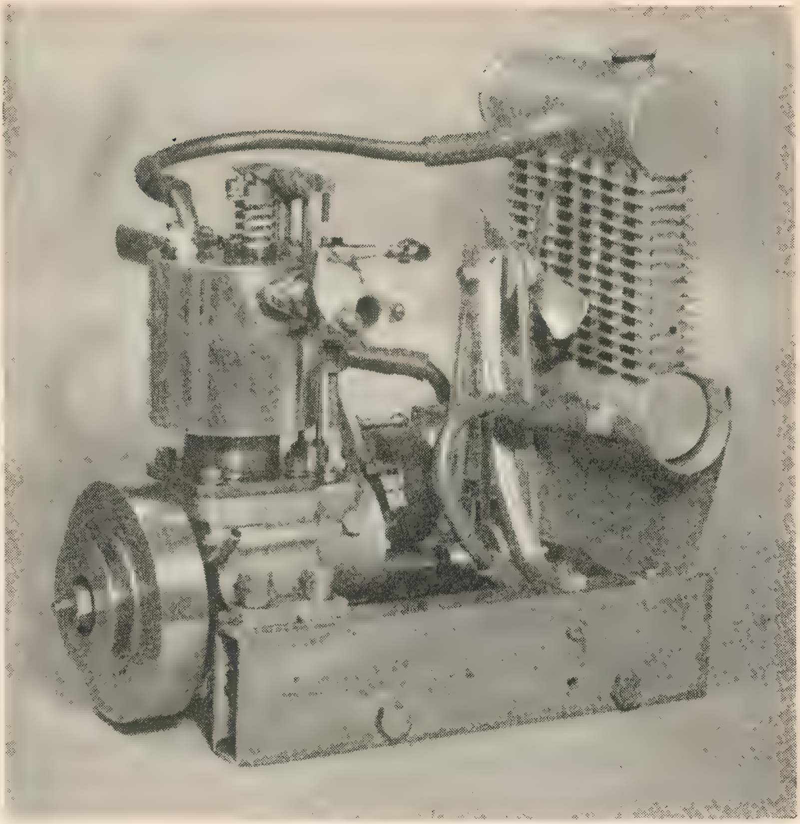
The Jig

This was made to Fig. 3, using two plates of mild-steel, ⅛ in. thick, for the job.

The oblong holes in the lower plate were the same size and shape as the flattened tubes, plus, say, 0.02 in. all round, i.e. a total increase in diameter of 0.04 in. to allow for the thickness of the tinplate lips, whilst similar-shaped holes made in the upper plate were the size of the tubes, plus, say, 0.006 in., the actual punch being plus 0.005 in., allowing the punch to fit the upper holes comfortably and punch out a hole in the tinplate that fitted nicely over the tubes with sufficient clearance. The holes in each fin were thus identically spaced, so that the final assembly had a really workmanlike appearance. (Photograph No. 2.)

The punch itself needed only to be of mild-steel, shaped to the holes of the upper plate as previously mentioned, with a chisel edge, so that when punched, the holes in the tinplate would have burred edges or lips that would assist in making a better soldered joint at a later stage.

The locating pins were slightly tapered to be a driving fit in the lower plate, but a clearance fit in the upper plate, the holes for these being drilled with the plates clamped together for accuracy of location. The two holes at each end for clamping the two halves of the jig together during the actual punching operation were made 2 B.A. clearance. Photograph No. 4 shows the jig opened out, with the chisel and a partially completed fin.



Photograph No. 3. The complete assembly mounted on Mr. H. W. Saunders' modified "Kiwi" engine

When making the prototype, a little more trouble was taken by first inserting each fin in the jig and scribing on it the outline of the holes. On removal, it was given a few sharp knocks with a small cold chisel and hammer, using a piece of hardwood as an anvil, along the dotted lines shown in Fig. 4, so that when replaced in the jig for punching, four evenly cut flanges were obtained for each hole instead of a jagged lip, giving a pleasing effect in the finished assembly.

The fins were then soft soldered to the tubes, $\frac{3}{16}$ in. apart, the final result appearing as in photograph No. 2.

Fig. 2. Shape of tubing after compression

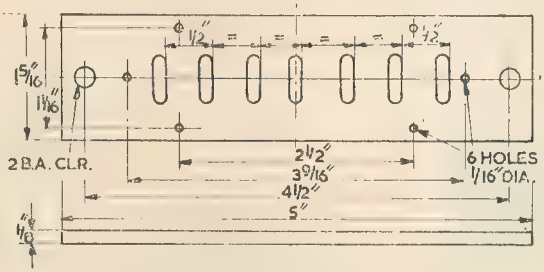


Fig. 3. Jig for holding fins whilst punching

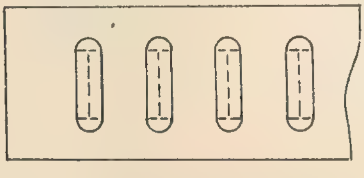


Fig. 4. Dotted lines show cross-cuts made with chisel preparatory to flanging

Fitting the Drums

This was a ticklish job, and great care had to be taken in marking the positions of the tubes on the drums for drilling out, by holding the ends of the tubes against the drums and carefully scribing their profile. These holes were formed by drilling a row of three or four holes of smaller dimensions than the final width required, finishing off with small files, and it was found important

(*Continued on page* 448)

IN THE WORKSHOP BY DUPLEX

An Independent Traversing Drive

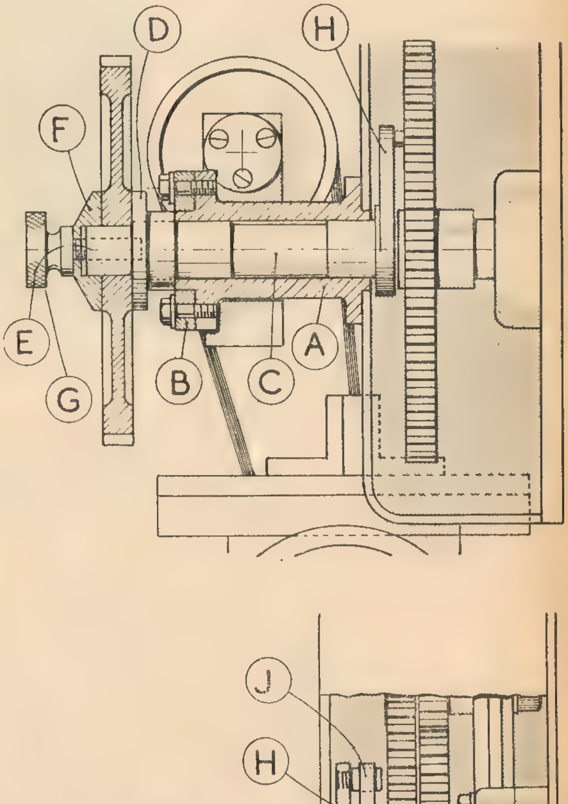
WHEN cutting gear teeth in the lathe, with the blank mounted on the mandrel, the gear-cutter, driven by the cross-slide milling attachment, is necessarily fed along the work by using the leadscrew to traverse the saddle by hand.

In these circumstances, labour will be saved, and better machining will result, if some form of power feed is employed to traverse the saddle automatically. But the leadscrew is normally driven through a gear train from the lathe mandrel, so that an independent drive is necessary where the gear blank remains stationary during the machining of the individual teeth, and the work is meanwhile indexed either from a change wheel secured to the lathe mandrel or by means of a dividing head. One way and another, we find that quite a lot of gear cutting has to be done, either for friends who have not the facilities, or for the components of geared mechanisms under construction in the workshop. This work has been considerably lightened now that the attachment, here described, forms part of the regular equipment of the lathe.

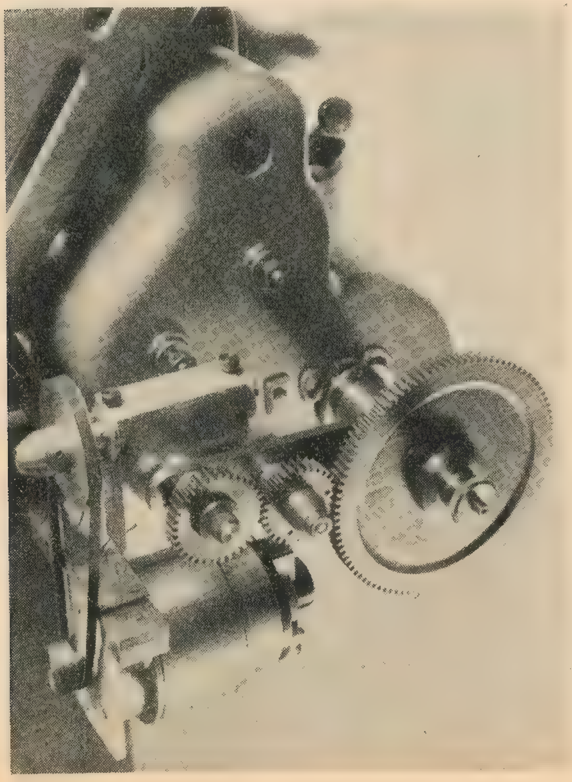
As can be seen in Fig. 1, the driving gear has been mounted on the gear cover of the Myford M.L.7 lathe, but with only slight modification to the leadscrew coupling, it also serves the Myford 4 in. lathe. Some years ago, we fitted a Myford $3\frac{1}{8}$ in. lathe with a similar kind of attachment, although this was secured to the lathe quadrant. As this proved so successful, it was decided to equip the two heavier lathes in the same way, for these machines are better adapted for gear cutting and are now always used for work of this kind.

Although it is usually preferable to

Right: Fig. 2. The attachment fitted to the Myford 4 in. lathe. A—the main bush; B—the carrier arm; C—the driving spindle; D—the change wheel drive collar; E—the spindle stud; F—the pressure plate; G—the finger-nut; H—the driving arm



Below, left: Fig. 1. The attachment mounted on the Myford M.L.7 lathe



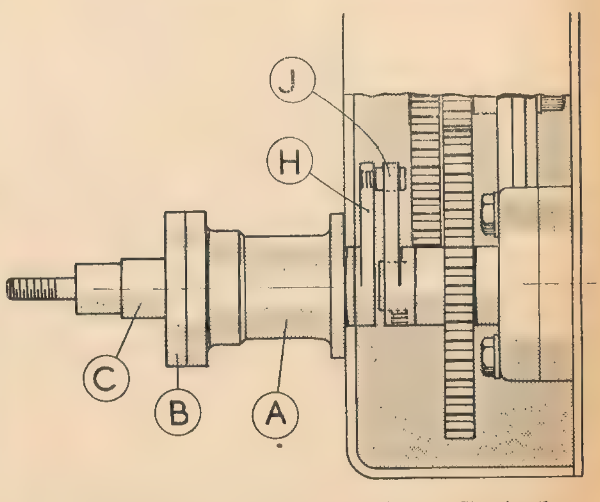


Fig. 3. The attachment fitted to the M.L.7 lathe. Showing the arm—H—driving the leadscrew driven arm—J

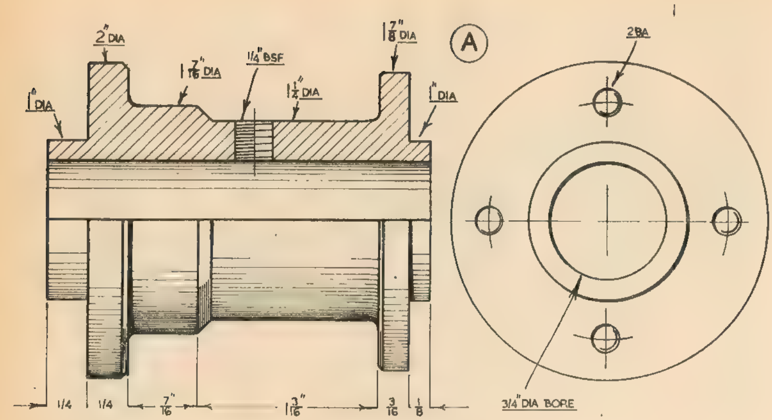


Fig. 4. The main bush

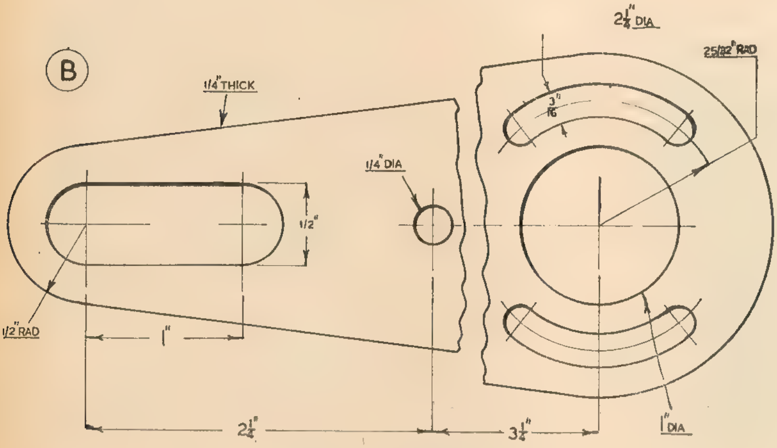


Fig. 5. The carrier arm

mount an attachment on some integral part of the machine, in the present instance the drive assembly is carried on the gear cover, for this fitting is of robust construction, and is rigidly fixed to the headstock casting; moreover, the power required to drive the leadscrew is very small, and there should be no danger of spring occurring in the drive at the point where the final pinion of the gear train engages with the leadscrew. One advantage of the attachment is that it can remain in place on the lathe, as it does not interfere with the normal automatic feed for the saddle from the mandrel pinion.

However, when the attachment is in use, it is advisable to remove temporarily one of the intermediate change wheels of the ordinary feed train, in order to reduce the load on the gear parts of the attachment. As can be seen in the photograph of the attachment, a small electric motor drives, by means of a V-belt, a pulley attached to the spindle of a worm-gear reduction box; thence, the pinion fixed to the worm-wheel shaft drives the leadscrew wheel through an idler pinion.

By fitting pinions of different sizes to the worm-wheel shaft, the rate of travel of the lathe saddle can be caried from approximately ½ in. a minute to 1¼ in. a minute; this will be found adequate for machining gear wheels of duralumin, brass, or steel in the commonly-used tooth pitches.

The sectional drawings, Figs. 2 and 3, show the driving mechanism applied to the Myford 4 in. lathe and the M.L.7 respectively, and it will be seen that the construction is identical, except for a minor detail concerning the type of coupling used to connect the driving arm of the appliance to the leadscrew.

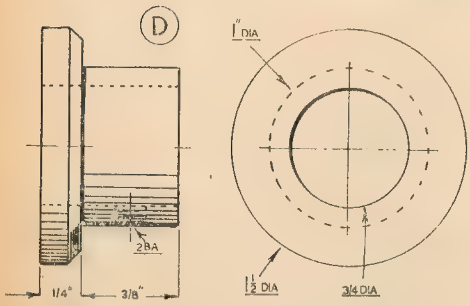


Fig. 7. The change wheel driving collar

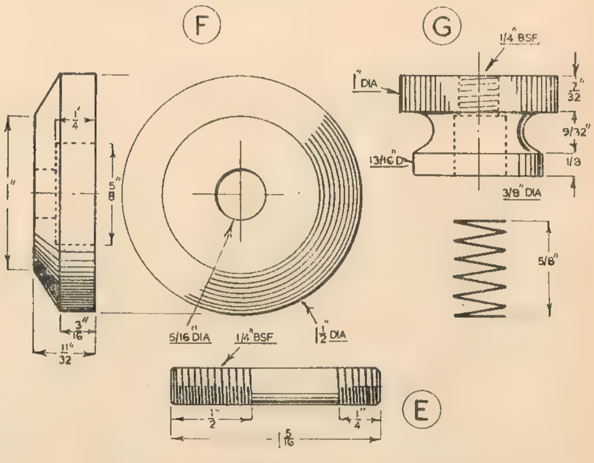
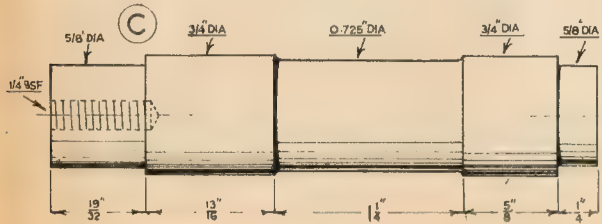


Fig. 8. E—the spindle stud; F—the pressure plate; G—the finger-nut and spring



Left: Fig. 6. The driving spindle

The main bush *A* carries the driving spindle *C* and is secured to the gear cover with four 2-B.A. screws. The hole to receive the register on the bush can be accurately located by first securing a pointed fitting to the end of the lead-screw, and then mounting the cover in place and tapping it with a mallet; this will make a centre mark from which to scribe a 1 in. diameter guide circle. The hole was actually bored with a cutter mounted in the drilling machine, and the bolting face was afterwards surfaced with a fly-cutter; for these operations, the casting should be firmly secured to the table of the drilling machine. The arm *B*, carrying the worm box and the intermediate gear wheel, is doubly slotted at its wider end so that it can be rotated to adjust the tension of the driving belt. At its narrow end, the arm is also slotted to provide the adjustment necessary when gear wheels of various sizes are mounted on the worm-wheel shaft, in order to alter the gear ratio of the drive. The spindle *C* is turned to a running fit in the main bush, and at its outer end it is fitted with a collar *D* and a stud *E*, so that the change wheel can be held in place by means of the pressure-plate *F* and the finger-nut *G*.

The collar *D* is fixed to the spindle with a 2-B.A. grub-screw, and it will be seen that the finger-nut is recessed to accommodate a small compression spring; this arrangement provides a frictional drive and also serves as a safety slipping clutch.

(*To be continued*)

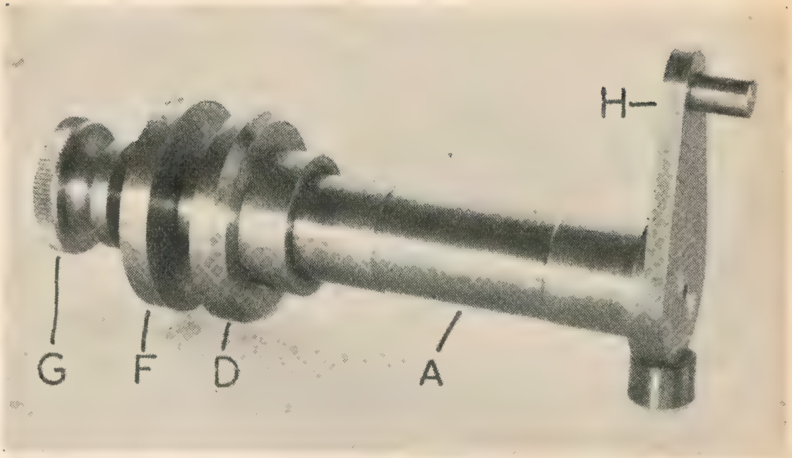


Fig. 9. The driving spindle assembly

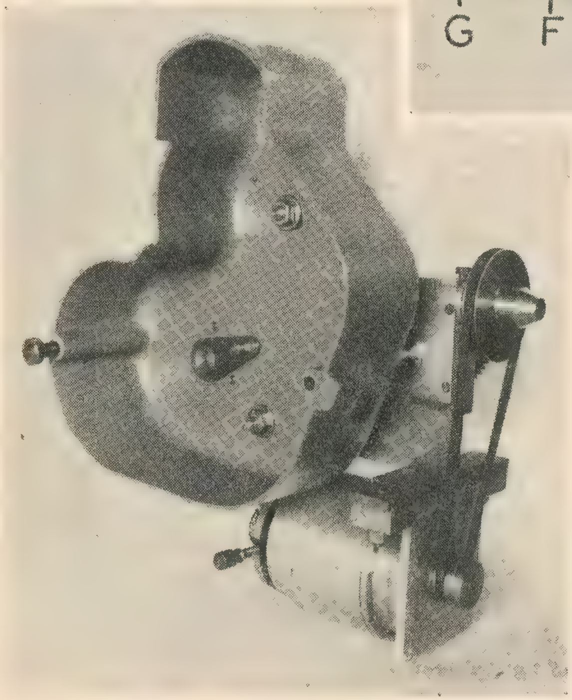


Fig. 10. Showing the driving arm within the gear cover and the general arrangement of the motor drive

Glass-fibre—Further Comments

In an article on glass-fibre plastics, on p. 227 of The Model Engineer dated February 24th, reference was made to the importance of suitable separating agents when using moulds.

Commenting on this, the concern of Bush, Beach & Gent Ltd., Marlow House, Lloyds Avenue, London, E.C.3. states: "The separation of polyester resins from their moulds is always a difficult problem due to the remarkable adhesion which these resins have to the majority of surfaces. As a general rule it is recommended that the surfaces of the moulds are painted with good high gloss paint and allowed to dry prior to the application of the separating material; two materials are generally used in this connection: polyvinyl alcohol and waxes.

"In the first case, our polyvinyl alcohol grade 25/14 is most generally used and is dissolved in a 4/7 per cent. solution for this purpose. The method of dissolution is to first soak the powder in cold water for about twelve hours to ensure that the grains are swelled, and the balance of the water is then added with continual stirring, at the same time raising the temperature to 80/90 deg. C. by means of indirect heating. This solution can be applied by swab, brush or spray. The addition of a small quantity of a water-soluble dye-stuff is suggested, as this will show up any spots which have been missed or have not received a sufficient coating.

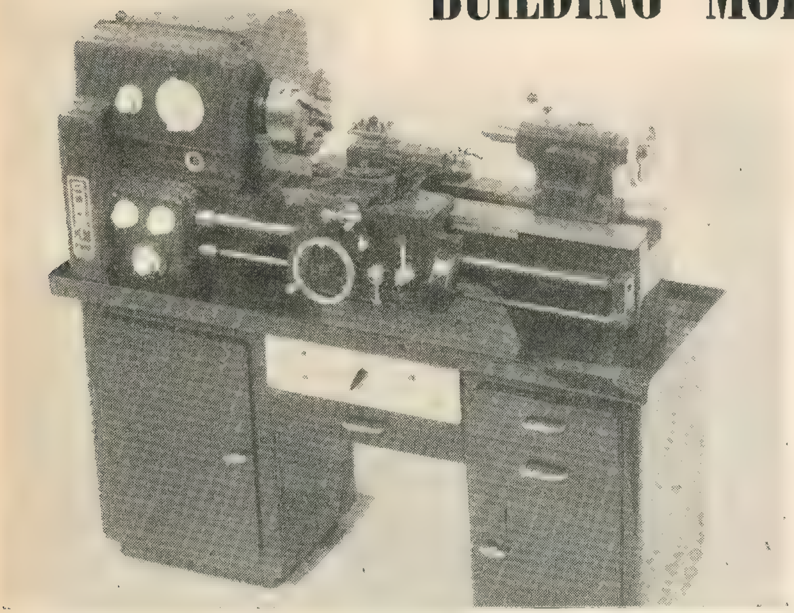
"An alternative parting agent is a wax (polyethylene wax) and in this case a 4 per cent. solution in carbon tetrachloride is coated on the mould before the initial coats of resin are applied."

The same company mentions the use of Aerosil, in connection with the prevention of run-off when applying resins to non-horizontal surfaces.

This material is a finely-divided silicon dioxide. By incorporating two to five per cent. of Aerosil by weight in the resin, a viscous thixotropic mixture is obtained, which can be adjusted to any desired working consistency. There are, of course, other applications in which an increased viscosity, such as is provided by this material, would be of value.

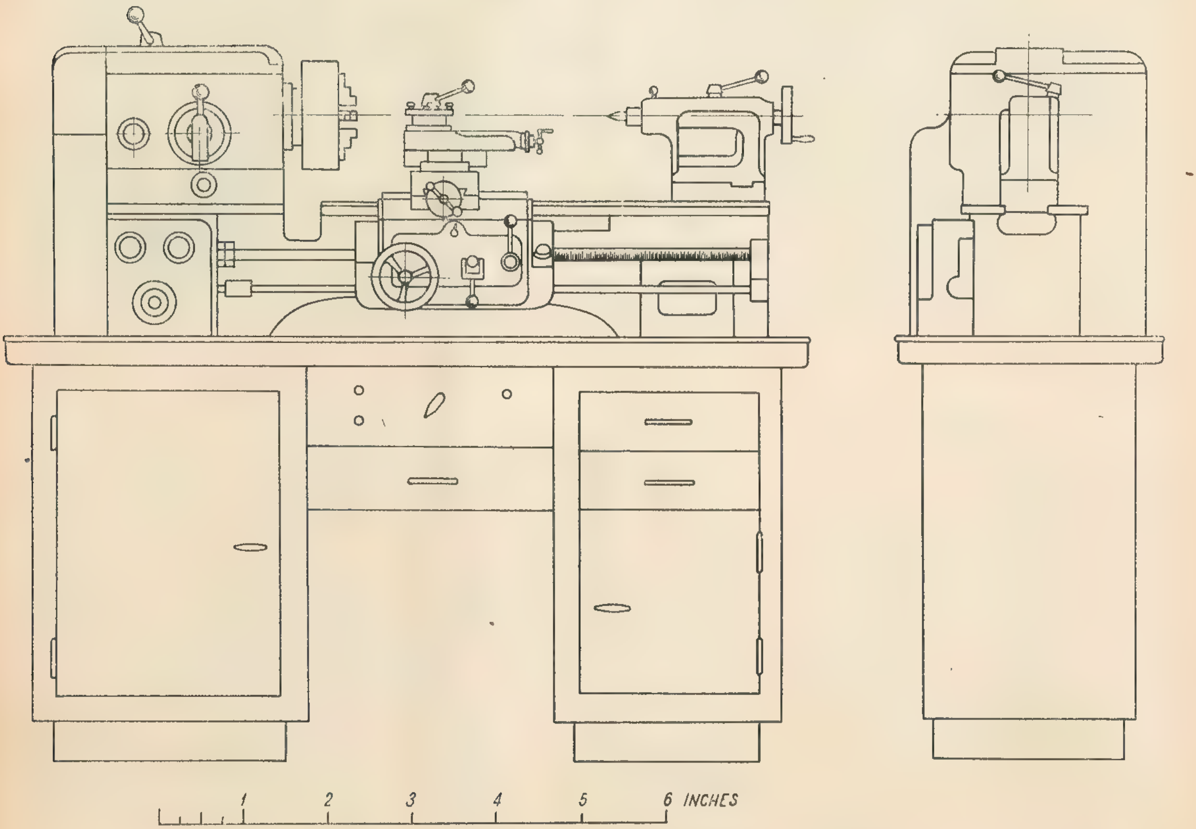
BUILDING MODERN MACHINE TOOL MODELS

By F. Surgey



The model "Churchill Cub" lathe

FROM my previous article published in the issue of THE MODEL ENGINEER, dated February 17th, 1955, the reader will have gathered how interesting the construction of these models can be, using only very simple tools and easily obtainable materials, in fact, quite within the scope of the beginner. In this article, however, I am describing the construction of the modern models and would like to point out that no castings whatsoever were used in the construction of the two models described here, which were built from a combination of hardwood and metal oddments.



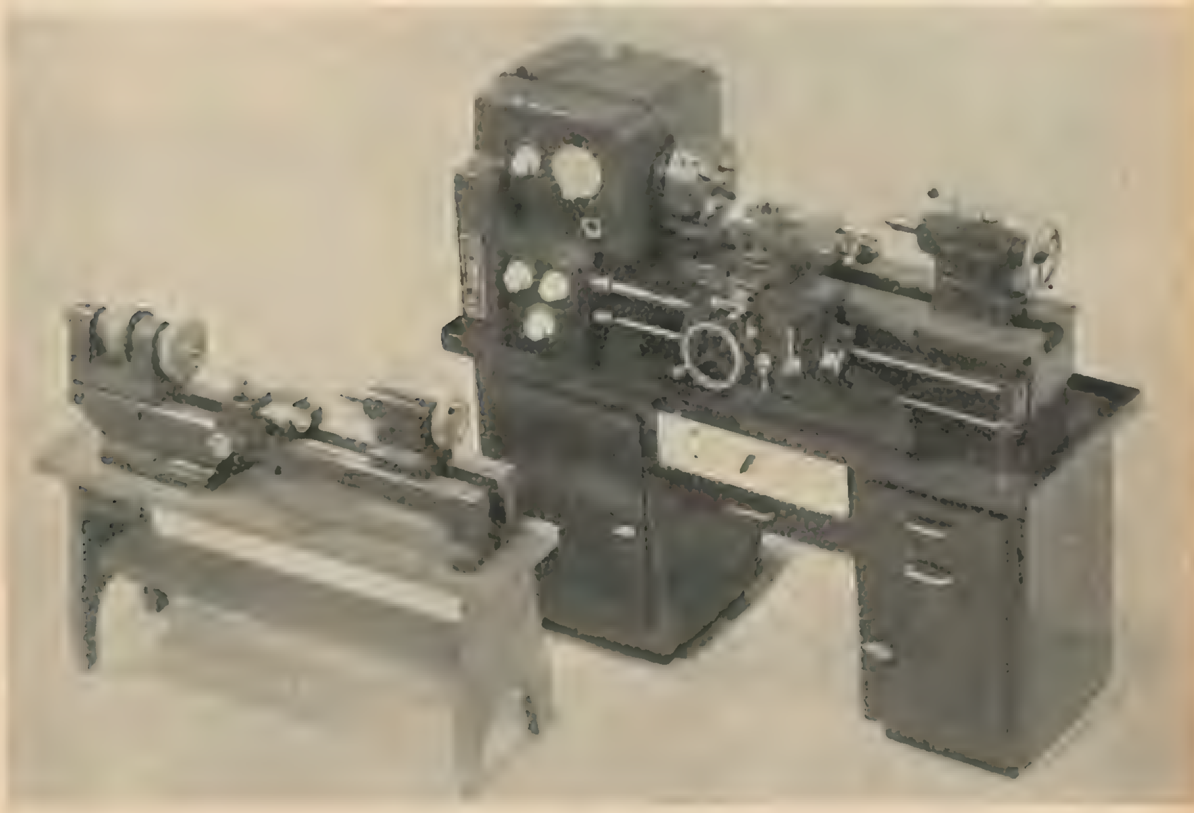
Elevations of the design for a model "Churchill Cub" lathe

I wanted to build a small modern lathe first and the problem was which one to select, or there are so many, and having written to several machine tool manufacturers I studied each one in turn and made drawings for several, both large and small, before I decided on the one illustrated here. I had only photographs and leaflets describing the machines, but it was not a big job to make a drawing from the illustrations, for the odd dimensions I needed most the model to 2 in. to 1 ft. scale, for it makes a good size of model, within the scope of a small workshop, and the scale was further governed by the size of the old machine tool models and material on hand.

The Lathe

The first section of the lathe model was the bed. This was cut and shaped from hardwood, two strips of ½ in. × ⅛ in. strip steel being screwed to the I will be able to drive this particular one from a shaft under the baseboard and drive the whole shop from one motor. After the gear-cover at the rear of the headstock was made, which by the way, is easily detachable for access to the driving belt, the small screw-cutting gearbox was made and fitted to the bed, but not before holes were drilled in it for the leadscrew and traverse drive shaft.

Next, the tailstock, which is also

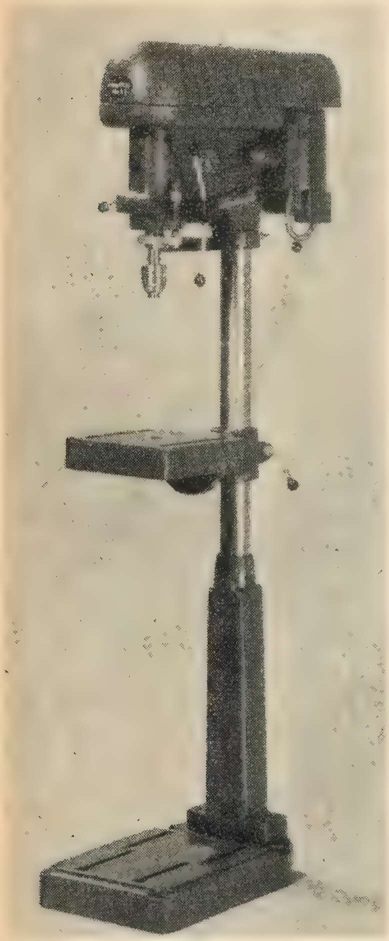


Models of lathes—the old and the new

were usually to be found in the specifications included in the leaflets. From these leaflets I made drawings of several types, but finally decided on the "Churchill Cub."

There are many other excellent designs, however, and if the reader prefers others, the method of constructing a model of this type is basically the same for most of the lathes. One thing I still cannot decide is, which of the modern designs are the best looking. I propose to make in due course a small model of the Smart and Brown lathe. This will be constructed from castings and about twice the size of the Churchill model, so it can be put to some use when completed.

The "Churchill Cub" is a lathe of the all-geared head type, and has a capacity of 6½ in. centre height by 2 ft. between centres, so I decided to build top surface of this bed, along which to slide the slide-rest and tailstock. This method looks very effective as you can see from the photograph, though I think it could be considerably improved by the addition of vees as in the actual lathe. The headstock was next carved from hardwood, and before attaching to the bed, it was drilled for the headstock spindle and small brass bushes inserted in the hole at either end of the headstock, so that the spindle could run freely in these bearings. This spindle is screwed at the forward end to take the chuck and at the tail end is fitted with a small pulley. The drive is simply from a small motor in the cabinet stand of the machine to the headstock pulley, the belt running through the gear cover which is hollow. It is perfectly simple and should I decide to put all these models together, from hardwood and which is fitted with proper barrel and handwheel. The tailstock may be moved along the bed, and is secured by a quick-release handle, the bolt for this passing straight through the tailstock, and having at the head end a small plate, which slides along the under surface of the ½ in. × ⅛ in. bed strips. A tailstock barrel locking lever, actually a dummy, is also fitted. The handwheel of both the tailstock and slide-rest were a very fortunate acquisition, for they are just the right size, and have three spokes; they came from a box of clock parts from a friend who is most helpful with oddments. The compound slide-rest was built up from hardwood and steel strip, being made to slide along the bed as in actual practice, but the remainder being non-working. By turning the handwheel, the slide rest can



The model "Progress" drilling machine

be moved along the bed. This has been worked by attaching a small gear to the end of the handwheel shaft, which passes through the apron. The gear, another one from an old clock, does not mesh with the rack, but meshes with the leadscrew.

The teeth in the dummy rack are filed in by hand so they are bound to be inaccurate, and the leadscrew which is a fixture in the model is just in the right position for the small handwheel gear to mesh with it. Leadscrew and traverse drive shaft were fitted, being held in position by the end bearing, which was not finally secured till after painting.

Control knobs on the headstock were turned from brass, and others made by soldering ball-bearings on the ends of wire. I first used this method as long ago as 1939, when I made a model bus, and used ball-bearings for the hand-knobs attached to the rear of the seats. Even now, these knobs on this model are bright after all these years, and with a little polish, shine like chrome, as they originally did when first made. The knobs on the lathe are all made in this same way and when painted red or black, they look just like their larger plastic counterparts.

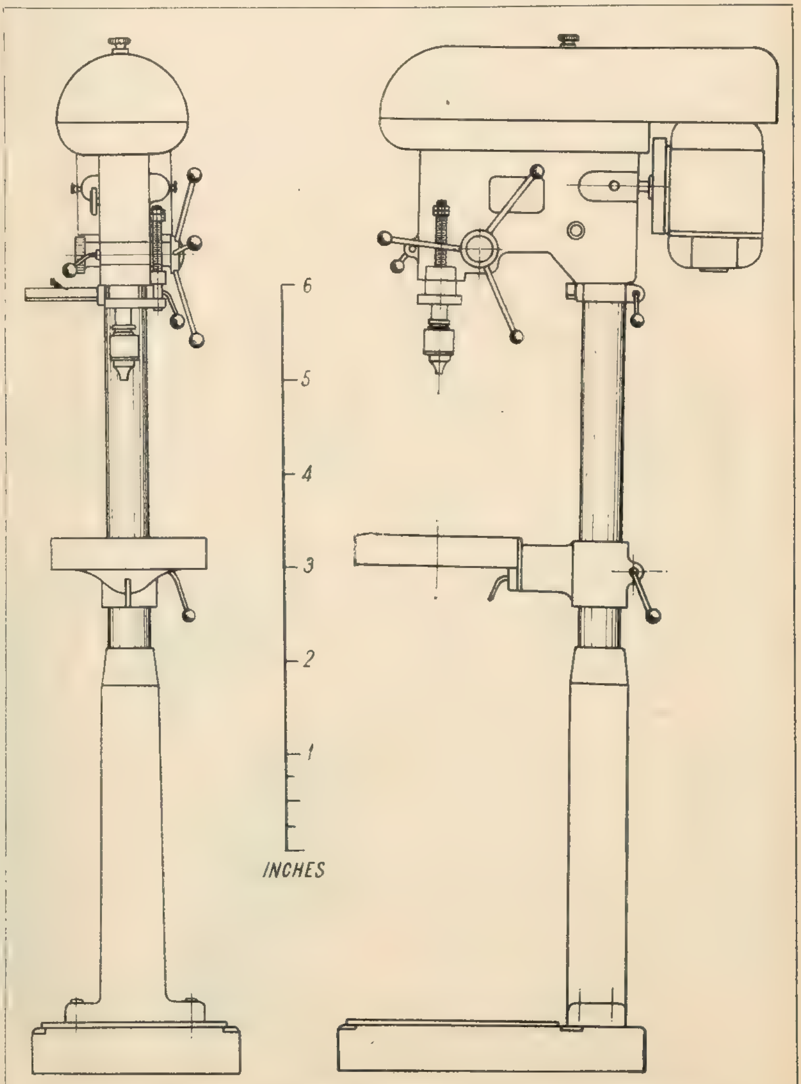
The chuck was turned from a piece of steel, and after tapping the bore and screwing on to spindle was returned to the lathe to be trued up on the spindle. Slots for the four dogs were milled in the chuck body, and the dogs, cut from $\frac{1}{8}$-in. steel strip, were attached to the chuck body with 10-B.A. screws.

The model was by now nearing completion, and so the stand or cabinet was made up from wood, and a tin tray, soldered together, attached to the top.

The switch panel was added, with dummy switch and push buttons, not forgetting door and drawer handles, which all add to the attraction of a model of this type. The model, after assembly, was taken apart for painting, several coats being applied and rubbed down, so a smooth finish was given to the wood parts. Certain of the small fittings were not added till the final assembly, for it is much better to paint them separately and fit them later when completely dry if possible. The driving belt, by the way, is one of the Meccano endless type, which I have found very useful for both old and new type tool models, and readily available in several sizes.

The Drill

Having been thoroughly satisfied with the result of the model lathe, I turned my attention to the drilling machine. The choice of this machine was not difficult, for there are several basically similar designs on the market, and as I possess one of the "Progress"



Elevations of a model modern "Progress" No. 1 type drilling machine

type, it is not surprising that I chose this one. Its construction was divided mainly into three sections, namely, base, table and head. The base was begun first, and was cut once again from hardwood; to this is attached the column base, which is also of wood.

The column base was drilled to take the column before this section was shaped, as I was afraid of not being able to drill a perfectly true hole after shaping. In an earlier model of the actual "Progress" drill, the column is steel throughout, but in the more modern one there is a shorter steel section and this cast-iron base, which of course limits the distance between chuck and table. The drill table was made next from hardwood, in several sections, and from the photograph the surfaces of both this table and the base appear to be of metal. This has been achieved by fixing metal plates to the wood surfaces, blending them together, so they look as if they are actually all metal. The bolt slots are cut through both metal and wood, so one cannot tell that the wood is underneath. The head was made from hardwood, and was very carefully shaped after drilling for the column and drill spindle.

The column is a piece of $\frac{7}{16}$-in. bright mild-steel, while the drill spindle is made much the same as in the old type drill, the lower end fitted with small chuck and the top with a pulley. It runs in small bushes pressed into the wood, and at the lower end, the "quill" is fitted with the small depth stop, as on the real machine. The usual type of handle with three arms and ball-bearing knobs is attached. On the other end of the handle spindle is a small turned spring-return device, which of course is also a dummy.

Motor plate and motor were turned from wood, and motor bolted to plate with four 10-B.A. nuts and bolts. Several lengths of wire were tried to represent the metal covering for the cable from drill head to motor, but none was suitable, and a short length of coiled spring used for model driving, which I think, is also of Meccano origin was finally fixed with very satisfactory result. The head cover was cut from a piece of hardwood and hollowed out for the belt drive. It is fixed to the head by a single long bolt and small knurled nut, as on the actual machine.

There are many small motors which could be adapted and fitted in place of the dummy motor on the model, but as I have not decided whether I shall fit separate motors to each machine, I have fitted the dummy motor for the time being.

If I want to arrange for a drive from under the baseboard, I shall drill right through the column or use a piece of tube for the column, so I can drive from a vertical shaft running through this, and down through the baseboard.

The remaining fitments were the drill table and a small table which is usually directly under the drill head and is useful in the actual drill for holding the chuck-key, drills or suds for drill lubrication. The drill table was made up similarly to the base, from hardwood faced with steel plate, and the smaller table from hardwood only. Each of these tables was fitted with small locking handles, but was not completed till after painting.

The final job was the painting, which is in both cases machine tool blue-grey, and they look very smart indeed, particularly in comparison with the older machine tool models.

A RADIATOR FOR MODEL I.C. ENGINES

(*Continued from page* 441)

to ensure that the tubes fitted snugly into position, otherwise some difficulty was experienced in filling with solder any gaps that were left.

Before soldering, all surfaces on the drums, round the holes and the ends of the tubes were tinned, and whilst doing this the inlet and outlet pipes and the filler cap were also soldered in.

It will be noticed that the positions of these items on their respective drums have not been given, as it was thought best to leave it for the individual to insert them in the positions best suited to his own engine layout requirements.

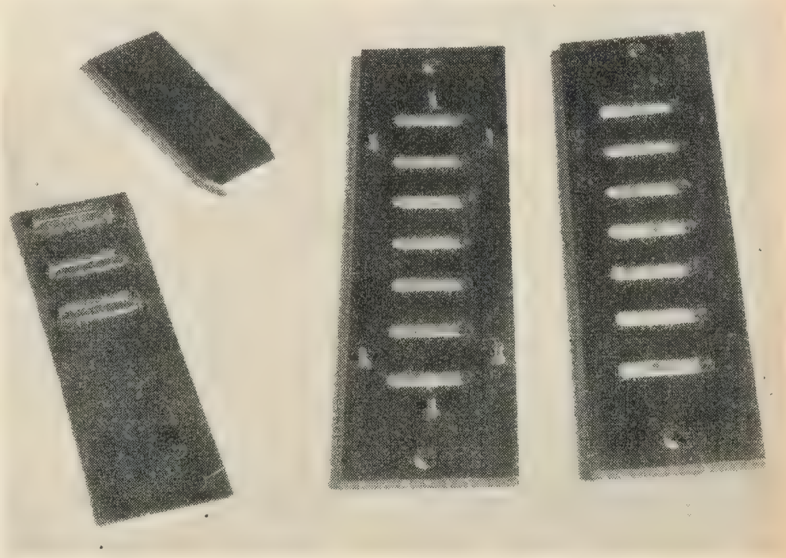
Conclusions

Although this completes the constructional data for the radiator proper, a few words on its use may prove helpful.

A radiator of this size and capacity will probably not prove adequate as a cooling device, using convection only, for any engine larger than about 5 c.c. It has been found advisable for engines of greater capacity to use a circulating water pump and in the case of Mr. H. W. Saunders' 15 c.c. modified "Kiwi," with which experiments have been carried out, auxiliary tubular water tanks were mounted inconspicuously under the deck, as the engine was used running flat out for periods of not less than half an hour at a time.

The power unit referred to is shown in photograph No. 3, complete with radiator, as used in several club regattas last season, where the launch in which it was installed won several events.

Grateful thanks are tendered to Mr. H. W. Saunders, of St. Albans M.E.S., for his assistance, and to Mr. Trevor Hawkins of St. Albans, for kindly taking the photographs.



Photograph No. 4. The jig, with chisel and partially completed fin

Build Your Own Lathe

By J. Bullas, G.I.Mech.E.

IT is some years ago now since I received my introduction into the fraternity of "model engineers," when, together with a friend of mine, we launched into the project of building two vertical steam engines $\frac{9}{16}$ in. diameter bore × $\frac{9}{16}$ in. stroke. He being the very proud possessor of a $3\frac{1}{2}$-in. round bed lathe of ancient vintage but having no power feed. However, much to our wives' consternation, night after night found us both in the close confines of his shed, very industriously making what my wife vowed would never work in any case. The models were eventually completed and, although I say it myself, they looked and worked very well. Soon after, my friend left our common place of employment, and, thereupon, my appetite whetted and the bug firmly implanted in my mind, I set about transforming my own little back shed into a workshop, with the thought that the future would see the installation of my own $3\frac{1}{2}$-in. lathe. The war now over, and with the price of machinery so prohibitive, I had to content myself with pottering about in the shed, performing all the odd jobs one is called upon to do, but my mind always dwelling upon the lathe that would one day be mine.

In September, 1948, I cut adrift and voyaged to Australia, as an emigrant, where for $3\frac{1}{2}$ years I had little opportunity to indulge in modelling. However, it was whilst "down under" that I came upon a rejected casting at our works which was "just the thing" for a lathe headstock. As a reject, permission was readily granted for me to take possession, and with this acquisition, along with the appropriate spindle, began the long task of building my own lathe.

The Headstock (Fig. 1)

Early in 1952 I was back in England, and weighing heavily in our luggage was my cherished casting. Upon seriously examining this, I found that the only fault appeared to be that the ball-race housings were slightly oval. These were soon scraped to take the 1-in. diameter ball-races, which were purchased from my employers, and the covers were made at work where my boss kindly turned a blind eye to my using a lathe in my own time. The cone pulleys were also made in like manner, and after many weeks, doing a bit each night, I was ready to assemble my headstock. As can be observed, lubrication is effected by means of a stauffer grease cup on each housing. Bearing in mind the need to provide for drilling and boring in the lathe, I also opened the nose of the spindle out to take a No. 1 Morse-taper shank.

The Bed (Fig. 2)

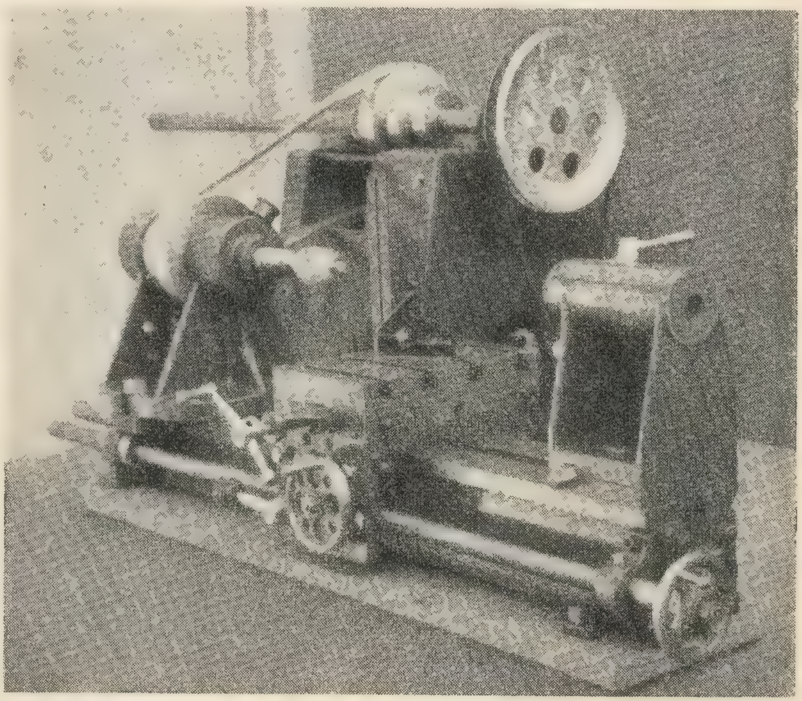
Basically, this presented little problem from a material point of view, as I had for some time past given much thought to the construction of this essential item, in view of the limited equipment at my disposal. Therefore, obtaining two 30-in. lengths of 3 in. × $1\frac{1}{2}$ in. mild-steel channel, I was able to have them welded along the upper and lower seams (flanges inwards) to produce a very substantial box-section. Two plates were also welded across the base for bolting down purposes, and three lugs, tapped $\frac{1}{2}$-in. B.S.W. were similarly secured to take the headstock. Now began the laborious task of cleaning up the top welded seam, by hand, so as to produce a face upon which to secure the shears.

After many long hours of filing, coupled with attendant blisters, I had finally scraped a surface to my satisfaction. The next job was to obtain two cast-iron strips 18 in. long, which were to be secured to the channel bed by means of socket-headed capscrews. These were duly obtained from a small local foundry, and again began the tedium of hand-scraping these to the required section, and also facing them with the prepared channels. I next drilled and counterbored the iron strips, this operation being performed with a $\frac{1}{4}$-in. capacity joiner's wheelbrace. The strips were now clamped to the channels with two standard $\frac{5}{8}$-in. wide keys being used to ensure parallelism of the space between them as this was ultimately to guide the tailstock.

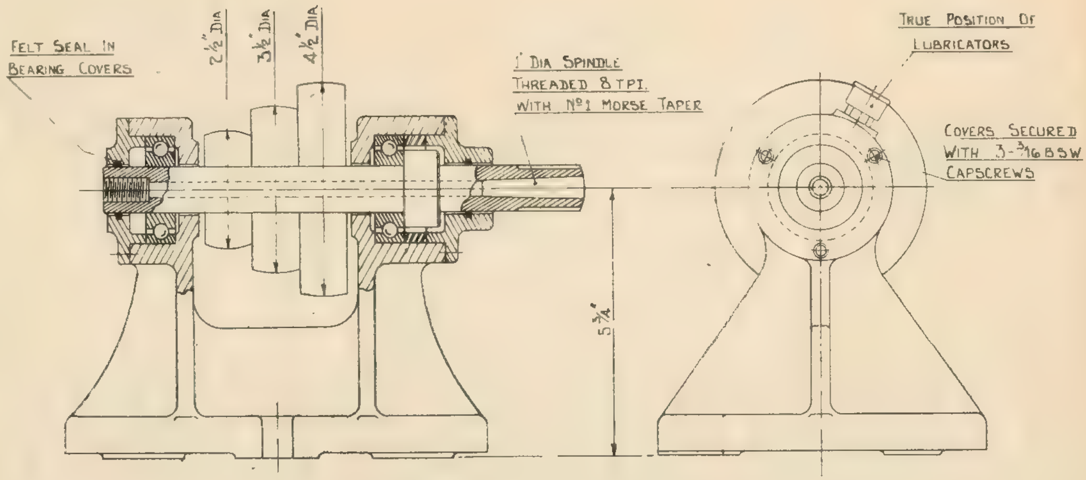
The channels were now drilled, using the strips as a jig. These holes were then tapped $\frac{1}{4}$-in. B.S.W., and the shears secured in position. My opportunity came to machine the surface of these when I was called upon to work one Sunday to supervise a special job. I thereupon took a light skim over the shears, on the planing machine, and at the same setting levelled off the three lugs for securing the headstock.

The shortcomings of the machine, which I had imprinted in my mind, were quite evident to me, inasmuch as screwcutting seemed out of the question, in view of the absence of any back-gear. In an attempt to overcome this, to some extent, I introduced a layshaft $\frac{7}{8}$ in. diameter running right through the bed itself, and in self-lubricating bearings.

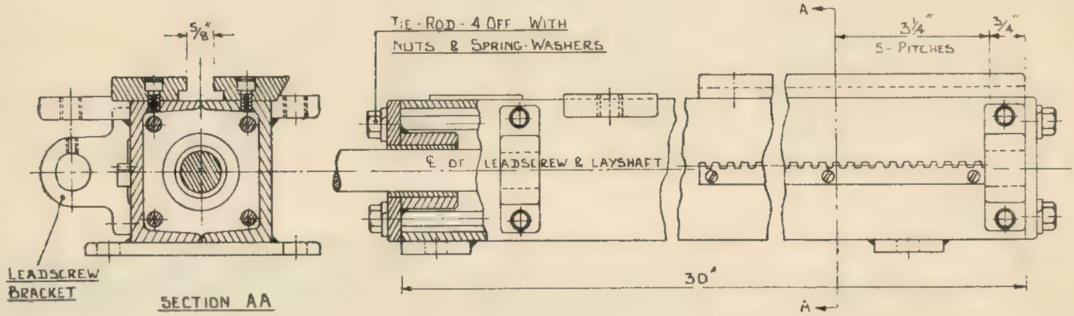
To fix the bearing housings, which consist of a boss welded to $\frac{1}{4}$-in. mild-steel plate, I used four lengths of $\frac{5}{16}$ in. dia. bar as tie-rods, which also pass right through



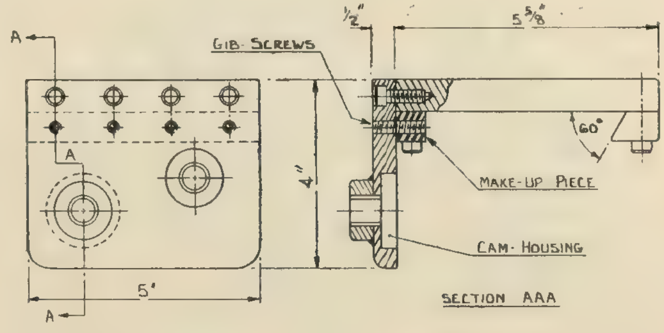
General view, showing v-belt drive to countershaft in background



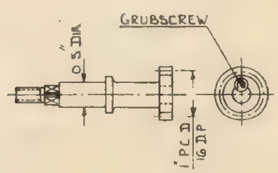
— HEADSTOCK — FIG 1 —



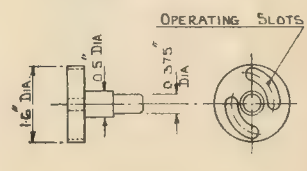
—-LATHE BED-FIG 2-—



—-SADDLE & APRON - FIG 3-—

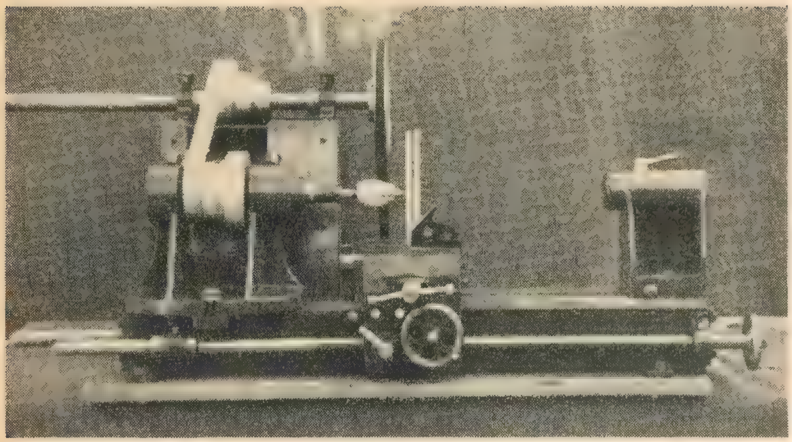


—-PINION & SPINDLE - FIG 5-—



—-OPERATING CAM-FIG 7-—

J.B.



Front view, with drill-chuck in spindle and six-inch square on boring table

the bed. My idea was to disconnect the drive to the headstock, and bring in a secondary belt from the countershaft to drive the above layshaft, which in turn would transmit the motion to the lead-screw and the lathe-spindle, the latter via a drive-stud in the rear end of the spindle, which I tapped ½-in. B.S.W. for the purpose. By this means, I calculated that I would be able to carry out limited screwcutting operations, and also obtain feeds for normal turning of 0.028; 0.015 and 0.009 per rev.

The Saddle and Apron (Fig. 3)

Having thus reached my first objective, I entered this round with no illusions, and indeed was fully aware that upon the accuracy of the saddle, in particular, my lathe would either stand or fall. The materials for the saddle and apron were two pieces of ½-in. mild-steel plate from the scrap dump. The piece selected for the saddle was now very carefully cleaned up, and the first face scraped until it was absolutely flat. The other face was now scraped locally at each of the four corners to give consistent references of uniform thickness to a micrometer reading. The whole of this face was now filed and scraped flat to these references, until the plate was parallel, the latter feature being my ultimate aim rather than any particular thickness.

Although simple to describe, I must here point out that the above occupied many evenings of work in view of what depended upon it. I next proceeded to square up one edge, in relation to these faces, to which I could attach the apron. The piece of plate destined for the latter was now cleaned up, on one side only, and the lower corners suitably radiused for appearance. This was now marked off along the top edge and drilled, again with the wheelbrace, to take cap-screws. I now clamped the apron in position on the saddle-plate and drilled through into the edge of the latter. Removing the apron, these holes were tapped ¼-in. B.S.W., and upon replacing the plate, its top edge was filed and scraped flush with the saddle.

The rear guide for the saddle was now to be considered, and I could see but little alternative to more hours of toil with file and scraper. Obtaining a piece of ⅜ in. square bright mild-steel by 5 in. long, I proceeded to form the 60 deg. bevel, to coincide with the shear, by use of hacksaw, file, etc., and then drilled four ¼ in. diameter holes for securing to the underside of the saddle-plate. To locate the guide-strip, a piece of ½ in. diameter silver-steel was used, and inside calipers applied between this and the apron to ensure parallelism between the two. Having located thus, the piece was clamped and the saddle drilled for tapping ¼-in. B.S.W. through the strip.

In order to allow sufficient space between the bed and apron for the nut-box, it was necessary to insert another mild-steel strip ⅝ in. square immediately behind the apron, secured to the underside of the saddle in the same manner as the near guide-strip. With this make-up piece in position, I next drilled four holes completely through this and the apron, and tapped them ¼-in. B.S.W. These were to take the gib-screws for applying pressure to the mild-steel gib, which is both supported and retained longitudinally by means of two 16-g. mild-steel brackets secured at each end of the above make-up piece by a $\frac{3}{16}$-in. B.S.W. round head screw.

The apron now came in for some personal attention in respect of the quick traversing spindle and the housing for the split-nut operating cam. Having decided, on the drawing board, their respective positions, I marked off the apron and drilled two ½ in. diameter holes. Obtaining two ½-in. std. collars, and locating same on the apron with ½-in. bolts, I had them firmly welded in position. Removing the bolts, the holes were then opened up to ⅝ in. diameter, reamed, and ½ in. bore self-lubricating bushes pressed in. Gripping the appropriate boss in a 3-jaw chuck, and ensuring the inside face of the apron to be true, I carefully counterbored the plate to house the nut-cam. In view of the precarious grip, I was decidedly relieved at the completion of this operation. The fillet welds of the frontal bosses were now cleaned up with a round file, and a generous corner taken off the sides and lower edge of the plate in an endeavour to create the appearance of a casting.

Top Slides and Boring Table (Fig. 4)

I had long previously decided against a compound tool-slide, having taken into account my limited equipment as against the extreme usefulness of a boring table, in conjunction with the No. 1 Morse taper I had machined in the spindle nose. Hence at this stage a pattern was made for the table, and this was cast at a local foundry, with the T-slots cored, the latter being filed up later on to take a ⅜-in. bolt shank. The dovetailed slides of the table, however, presented quite a problem, until our machine foreman offered to machine the table complete himself over a period of time.

In all probability, I shall here be accused of cheating, but, needless to say, I accepted his offer, and myself set about the task of preparing the top-slides. These were tackled by obtaining a piece of bright mild-steel 1½ in. × ⅜ in. section, and of sufficient length to cut both slides from it. Again more hacksawing, filing, and scraping was necessary to produce the 60 deg. angle to fit the table dovetails. However, at last these were complete and drilled in readiness, and I had also prepared a ⅛ in. thick C.I. wearing strip. Came the day when my table was complete, and I was faced with the problem of mounting the mild-steel slides on to the top of the saddle-plate in the exact position for locating the boring-table. This, of course, had to be true, so that ultimate cross-feeding would be normal to the spindle axis.

The problem was overcome by placing the slides in the table dovetails, with two ⅛ in. diameter steel balls in place of the wearing strip, and then locking the slides in position by two ¼-in. bolts and nuts between them. Two end plates were prepared and secured to the ends of the slides with ⅛-in. B.S.W. set-screws. Removing the locking bolts, the resultant frame was tapped out from the table, the steel balls helping here by their rolling action. A length of ½ in. diameter silver-steel was now placed in the dovetail of what was to be the leading edge of the boring-table, and a micrometer reading taken over the silver-steel and this edge. As the dovetailed slide must coincide with the table dovetail, then a very simple calculation enabled me to determine the distance from the leading edge of the saddle-plate to the same piece of silver-steel, which was now used to locate the slide-frame.

(To be continued)

A 10 c.c. General-purpose Four-stroke

MINOR DETAILS OF VALVE OPERATING GEAR

By

Edgar T. Westbury

Valve operating gear components; the examples shown were made for the experimental version of the design, and are not identical with the detail drawings

BY way of a little light relief, it may be as well to deal with some of the small components which, while quite simple and straightforward to machine, are by no means insignificant in the general scheme of things. Errors either in the design and accuracy of these parts, or in the selection of the materials from which they are made, have often been known to mar the success of an engine which in other respects appeared quite promising ; as in so many other things in life, small details often assume very high importance in their total effect.

In most full-size petrol engines, and particularly those intended for high performance, the valves are made of special high-tensile heat-resisting steel, and if supplies of this are obtainable, it may be used with advantage in the present case, though the conditions are by no means so exacting, by reason of the short running periods, and more rapid heat conduction in a very small engine. Some of the " super " valve steels are by no means easy to machine, while the use of composite valves, having a head of special steel resistance-welded on to a stem of low-tensile steel, is hardly practicable for a small valve. Nickel or nickel-chrome steel, such as used in many aero engine bolts and similar components, will give quite good results, and stainless-steel, including the " free-cutting " variety, obtainable from dealers in model engineering materials, has also been found suitable.

Some constructors have found it difficult to turn the slender valve stems satisfactorily, and I have had many requests for advice on this matter. Attempts are sometimes made to turn them between centres, either singly or back-to-back, but apart from other objections, it is not generally advisable to centre-drill the ends of the stems, and if extra length is allowed for cutting away the indentations, the tendency to the stem to spring away from the tool is accentuated. My method of machining the valves is to hold a piece of bar in the chuck, with sufficient length extending to allow the stem and head to be machined all over at one setting ; if the bar is set to run dead true, it is practicable to use $\frac{3}{8}$ in. material, but otherwise it will, of course, need to be sufficiently oversize to allow of skimming over the head diameter. About $\frac{1}{4}$ in. of the end is reduced to the finished diameter of the stem ($\frac{1}{8}$ in.) and carefully chamfered off at an included angle of 60 deg. It is then possible to support the end with a female centre in the tailstock (don't forget to keep it well lubricated !).

The portion of the stem which works in the guide must be dead smooth, parallel, and a close fit, the latter being of special importance in the case of the inlet valve, as any air leakage in the guide impairs carburation, even in full-size engines, and still more in small ones. By using a keen round-nose tool, with plenty of top rake, it is possible to get a good tool finish, which should be left a little on the tight side and finally lapped, not in the guide itself, but preferably with a split bush of copper or aluminium held in a carrier or die holder, and using a very fine abrasive such as powdered aluminium oxide in thick oil. The radius under the head of the valve should be highly finished, and the seating turned by swivelling the top slide to 45 deg. and using the same round-nose tool. A fine parting tool may be used to turn the groove in the end of the stem ; this may call for special care, especially if very tough steel is used, due to the inherent tendency of parting tools to snatch, but a keen tool, properly set and well lubricated, will produce the desired result. All these operations should be carried out at one setting ; the valve can then be parted off, and the top of the head cleaned up.

Valve Collars and Retainers

The material specified for the collar is mild-steel, which is generally quite satisfactory, but as this part often gets bruised or burred in assembly and dismantling, the use of a tougher steel, or, alternatively, light case-hardening after machining, may be found worth while. It may be turned at one setting, by facing, recessing and drilling the end of a $\frac{3}{8}$ in. bar, then taper-turning to about 10 deg. included angle with the round-nose tool, and finally parting off. The bore should be a close fit on the valve stem, and the shoulder should fit the internal diameter of the valve spring so as to locate it centrally.

For the collar, a small steel washer, slotted out to slip over the groove of the valve stem, and of an external diameter to fit the recess of the collar, may be used ; but as the shear stress on this part is considerable, I have found it better to make it from " semi-hard " spring-steel sheet of 20 gauge. If one has access to a small flypress it would be worth while to make a tool for blanking out these retainers, and as it is an item which only too easily gets lost when servicing engines, an ample supply of spares is advisable.

Incidentally, I have used practically every known method of retaining valve springs on small engines, and have found this device to give the best all-round results, but if any constructors have different ideas, the advice of that philosophic war cartoon character " Old Bill " is applicable.

Valve Rockers

These may be made from rectangular steel bar, $\frac{5}{16}$ in. square by $1\frac{3}{8}$ in. long, but some constructors may find it more convenient to machine them from $1\frac{3}{8}$ in. round bar, to avoid intermittent cuts when machining ; in either case, a certain amount of sawing to produce the external contour will be called for. The

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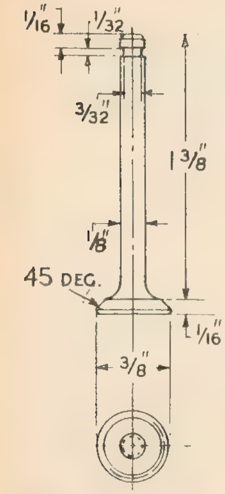
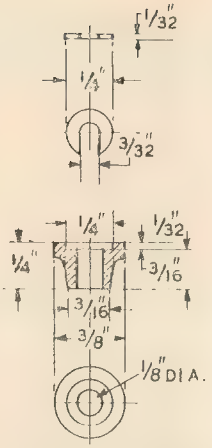
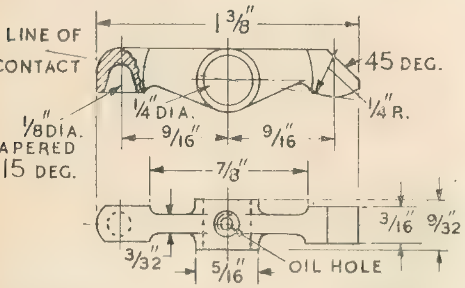


VALVE 2 OFF H.T.S.



COLLAR & RETAINER 2 OFF M.S.



ROCKER 2 OFF M.S. C.H.

material is first set up for facing, recessing and drilling one side; if rectangular bar is used, it is, of course, set crosswise in the four-jaw chuck, with its geometrical centre marked out and set to run true. The bored hole should be finished with a reamer or D-bit to produce as accurate a surface as possible. To machine the reverse side, a pin mandrel is used for mounting, and as the torque load in recessing and facing may be heavy, it will be found worth while to screw the end for fitting a securing nut, interposing a thin sleeve between this and the work so that access to the centre boss is not interfered with.

Having machined both sides of the pair of rockers, the surplus material at the edges can be sawn away, and they can then be mounted on a bolt or dowel-pin for filing up together. Take care to round off the working face of the finger which makes contact with the valve stem as smoothly as possible, and also to ensure that the web of the rocker adjacent to this will not foul the valve collar when in position.

An important point in the geometry of the valve gear is that the contact surfaces at the two ends of the rocker should lie exactly on a line passing through the pivot centre, and also that the range of rocking movement should be as nearly as possible symmetrical above and below the horizontal position of this line. This avoids unnecessary side thrust on the valve stem, which would otherwise be caused by the deviation between the straight-line movement of the valve and the arc of rocker movement; by keeping the centre-line of the latter near horizontal, the difference is so small as to be practically negligible, provided that the valve lift is not excessive in relation to the length of the rocker.

The push-rod socket is drilled sufficiently deeply to avoid risk of shedding the rod at high speed (I may mention that I have never encountered this trouble with my engines, though certain types of motor-cycles in the past were not immune from it!) and it will be worth while to make or adapt a cutter or D-bit to form the shape shown, as it will also be required for the sockets of the tappets. The end should be nicely rounded, and the sides at an included angle of about 20 deg., so that they do not foul the push-rod when it is at maximum angularity.

The layout of the valve gear, and method of adjustment, follow similar principles to those of the "Kiwi" engine, which have been found highly satisfactory over a period of no less than twenty years, and quite frankly, I have not found how to improve upon them yet! Though the alignment of the push-rods with the rockers and tappets is not ideal, the side thrusts introduced thereby are not excessive, and are well resisted by the adequate bearing surfaces of these components; with the particular mechanical arrangement used, alignment could only be improved by using a much more complicated link between cam and push-rod—such as a pivoted cam rocker, for instance. Again, the necessary provision for tappet adjustment can be, and often is, obtained by means of an adjusting-screw in the rocker or a turnbuckle in the push-rod, but in a small engine it is difficult to incorporate such arrangements without increasing the inertia of these parts. The eccentric bush arrangement, however, avoids this disadvantage and has been found entirely satisfactory; incidentally, the detail drawing of the bush itself will be given later. Enclosure of the valve gear, for engines which do not run for very long periods, has not been found of any great advantage, and may increase the difficulty of valve cooling.

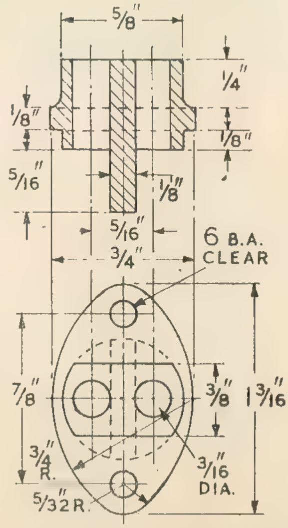
The rockers should be case-hardened, with special care to get the compound well into the push-rod socket, and afterwards the bore, the finger, and the inside of the socket, should be highly polished; the rest of the surface may well be left with the grey finish produced in hardening. It is possible to make the rocker much prettier than it is shown here, and also to dispense with superfluous metal here and there; but this is up to the individual constructor.

Tappet Guide

A casting is desirable for this component, though it can be machined from solid bronze stick without much difficulty. In either case, a substantial chucking-piece at the top end is desirable, and should preferably be turned parallel beforehand, for reasons which will appear later. The under face and spigot should then be machined, the latter fitting closely in the bore of the seating in the crankcase. It is now advisable to mark out the positions of the tappet bores, and these may, with advantage, be drilled and reamed by setting over the work in the chuck, or in a vee angle-plate; in this way their parallel alignment can be guaranteed to a degree which is not possible when a drilling machine is used. The spigot is now cut away to leave a tongue in the centre as shown, and this is a job which can well be done with a milling spindle, though hand filing is permissible.

While set up in the lathe, the upper face and boss can also be machined, and the piece parted off; the flats on the side, which exist simply for the purpose of removing unwanted metal, may either be milled or filed. The contour of the flange can be shaped either by filing, or by machining methods which have been described in previous issues, and it then remains only to drill the two holes

(*Continued on page* 457)



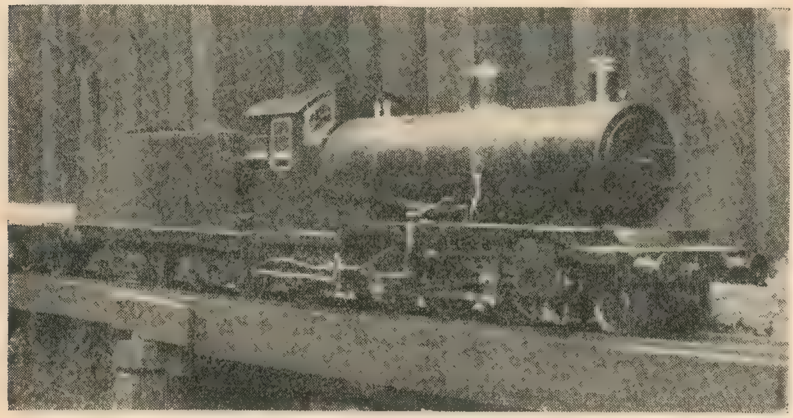
TAPPET GUIDE 1 OFF BRONZE

L.B.S.C.'s Lobby Chat

● **FACTS ARE CHIELS THAT WINNA DING**

SINCE the publication in the correspondence columns, of the various views on the subject of crosshead fixing, and my own reply to Mr. Davies and his own particular experience, I have received many direct letters on the subject ; and in every case, the writers say that they have not any knowledge of a properly-fitted pin shearing under working stress. On the contrary, two or three assert that they have had the very dickens of a job to persuade the piston-rod to part company with the crosshead, after removing the pin, when on the job of taking out a piston, through the front end of the cylinder, for examination and re-packing, when necessary. There have also been a few caustic comments on the assertion that a job which has stood up for over 32 years, and given no trouble, is "definitely bad practice." One writer in particular, sent an item of news which will be of great interest to the brethren of the Most Ignoble Order of Aginits, so here it is.

This reader has a friend who owns a 3½ in. gauge locomotive, which started life as a *Princess Marina*—a L.M.S.-type 2-6-0 of the Stanier era, which I designed many years ago—and was eventually converted to a G.W.R. of the same type. The crossheads of this engine were fitted to the piston-rods in the manner I always specify, viz., a good drive fit, but *they were not pinned.* This locomotive has done over four years' really hard work, on up-and-down tracks, hauling loads of children at fetes and similar functions, and up to time of writing, *there is not the slightest sign of the crossheads moving on the rods.* Had they been pinned, the shearing stress on the pins would have been exactly nil ; so how they could have ever had any tendency to shear, is, as "Lord Dundreary" is reputed to have remarked : "somethin' no fellah can ever understand." Perhaps the M.I.O.A. can explain *that* away ! The correspondent who sent the information, enclosed a cutting from a local newspaper, showing a picture of the engine (a realistic-looking job) hauling a load of kiddies at the Corpus Christi fete in Ellenborough Park, Weston-super-Mare ; but "print" pictures won't reproduce.



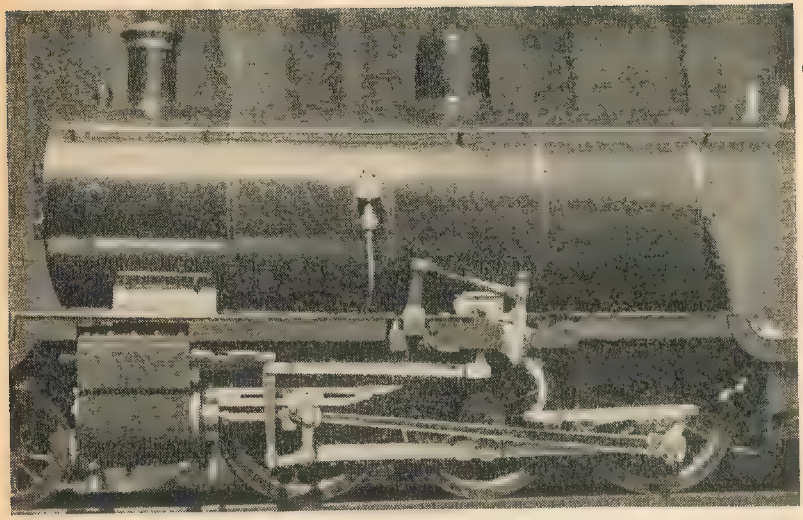
Mr. O. C. Trott's not-so-"Little Jack Horner"

The Hardest Job

It has also been stated in the correspondence columns, that a small locomotive working on an up-and-down straight track, seldom works to its full capacity, and it is a different matter on a continuous track with heavy grades. Without putting too fine a point on it, this assertion betrays a complete lack of practical experience, as the exact opposite is actually the case. In the old days, any of the old L.B. & S.C.R. enginemen could have told of the terrific strain on the mechanism of the "black tanks," or "small radials," during a night's heavy shunting at Norwood Junction, Willow Walk, or any other of the big goods depots. If there should be anything "coming loose," humping rakes of thirty or forty wagons from one siding to another soon found it out. When the district superintendent (they call him "shed master" now !) gave them a break on a day excursion to the south coast, they considered it a taste of heaven, and far easier work for the engine. Surely it should be obvious to the veriest Billy Muggins, that the effort required to start a load, is many times greater than that required to keep it going. Any reader who is doubtful, can easily test this for himself, whether he is a locomotive-builder or not. Fill the garden wheelbarrow full of stones, and push it backwards and forwards for a few feet, for about thirty times. Then give it just one push, and carry on right around the garden without stopping. You'll jolly soon find out which is the easier job !

At my old home at Norbury, I had a straight line roughly 65 ft. long, which was level when first erected, but soon developed "'umps and 'ollers," owing to the ground being soft in places, despite the fact that each post stood on an 18 in. square of pitch-impregnated wood. *Ayesha* ran on this, from the time she was first built, until we crossed the big pond ; and as passenger-hauling was then an innovation in 2½-in. gauge, I had quite a lot of visitors, and she pulled some really heavy loads. I let various folk drive her, and they were none too skilful at handling the regulator ; so it doesn't need a Sherlock Holmes to deduce that her mechanism sustained some awful shocks. If the crosshead-fixing had really been the "definitely bad practice" that the M.I.O.A. would have us believe, the pins would soon have sheared ; but they just didn't ! At that time, she had a feed pump $\frac{5}{16}$ in. bore × $\frac{3}{8}$ in. stroke, and when amateur enginemen were at the throttle, it was all she could do, to maintain water-level, while the fire had to be constantly made up to keep the needle of the steam gauge on the proper side of the case. Same conditions applied when she was doing all the passenger-hauling at the New York Exhibition in 1929.

When my present line was opened in November, 1936, she was the first locomotive to go into regular service, and it must have been a glorious relief for her. Even when hauling loads such as she had taken on the old straight tracks, the pump promptly flooded the boiler when the by-pass was closed ; and I soon fitted a much smaller pump with a ram 6 mm. dia. Even that needed a certain amount of by-passing to prevent the boiler flooding. She also burnt far less coal than when running at Norbury, though travelling at a much


"The Works" of Mr. O. C. Trott's "Little Jack Horner"

higher speed, and keeping on the run, sometimes covering two miles or more without a stop. As the work that a locomotive will do, is directly proportional to the amount of fuel and water that it consumes, it follows that she *must* have been working with far less effort, although covering a greater mileage at a higher speed.

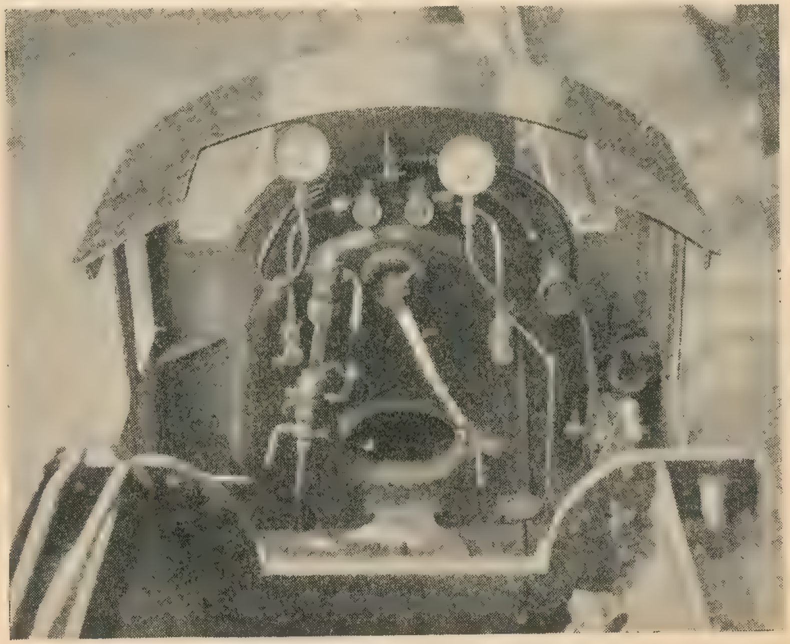
The hardest work of all is done by locomotives which are used on portable tracks at various fetes, etc., jobs as mentioned earlier. These tracks are not only rough, being usually rusty and dirty, but are not usually level, as they have to be erected on whatever site may be available, and it usually doesn't happen to be comparable to a billiards table. Running on a track such as the Beech Hurst line, is just a piece of cake in comparison, despite the so-called "heavy" grades; and, incidentally, those on the line mentioned, do not compare with those on the now-dismantled line at Bursledon, where a 2½-in. gauge locomotive regularly took a three-passenger load up a grade of 1 in 70, which included an S-curve. There is another point about running on a continuous track that is usually overlooked. However severe the grades, they are compensated; they *must* be, otherwise there would be a "step" in the line at some place. We all know the old saying that "what goes up, must come down" (exceptions being the price of coal, gas, railway fares, and so on!) and starting from a given point on any continuous track, every rising gradient must be balanced by a falling one, otherwise the ends wouldn't join up. In full-size practice, advantage of falling grades is taken to conserve power for rising grades, wherever possible; every good driver knows how to nurse his engine. On the small lines, falling grades will assist the engine by storing up momentum in the train, in much the same way as the cars on a roller-coaster. I'm not denying for one moment, that some drivers of small locomotives deliberately brake their trains near the foot of a rising gradient, to show off the prowess of their engines—I've done it myself, on occasions, just to "take a mickey" out of somebody trying to be facetious!—but even if they come to a dead stand, the restart is no harder than starting on the level with the maximum load that the engine will shift. No engine can put forward any more than its maximum tractive effort!

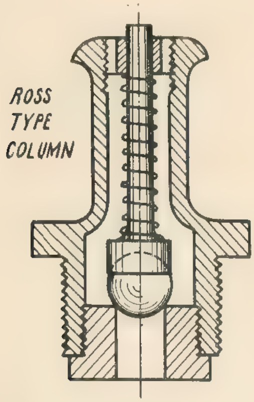
Finally, I recounted some time ago, how the original *Fayette* tried to straighten out a three-link coupling when starting a heavy load on a rough club track which was anything but level; her pinned crossheads never sheared, but there is no record of her ever trying to treat a coupling in similar manner on a non-stop run, which is pretty conclusive evidence as to which is the harder kind of work.

"Little Jack Horner" Grows Up

Older readers who follow these notes may possibly recollect that a long time ago, I was requested to give a design for a small but powerful locomotive that would haul a live load "around the Johnny Horners" as the kiddies would say, of a continuous line laid in the limited space of a small suburban garden. I responded with details of a 2-6-2 about the size of *Ayesha*, but arranged as a narrow-gauge type of engine, the gauge of the little one being 1¾ in. With a short wheelbase, and leading and trailing pony trucks, she would almost run around the edge of a dinner-plate, in a manner of speaking; and the little coupled wheels, combined with large cylinders and plenty of boiler power, provided the needed tractive effort. I called her "Little Jack Horner"; Jack, in this case, being an abbreviation of Jacqueline. A fair number were built, and I received some good accounts of their work; but I didn't know that she had "grown up," until I received some photographs, reproduced here, from Mr. O. C. Trott, an Essex reader.

I have no details of the "teenager," but the pictures will give some idea of the nice work that Mr. Trott put into


A neat arrangement of fittings



Safety-valve with slender column

her. He says that he just increased given dimensions in proportion to size, but fitted Baker valve-gear; I recollect lending him one of my little working demonstration gadgets, some years ago, so that he could see how the valve gear operated. Although the locomotive is 5-in. gauge, she runs around the curves on a line laid in a garden only 35 ft. wide; but it is hardly necessary to add that a permanent speed reduction is in force! However, she can do the knots when opportunity arises, as she has demonstrated on the club tracks at Romford, Chingford, and Birmingham. Since she was completed in 1949, she has done a considerable amount of charity work, earning many pounds for hospitals, churches, and so on.

The back numbers containing the drawings and instructions are long since out of print; but if any readers are interested, and would like to build a similar type of locomotive for pulling big loads on lines where trackage space is limited, and curves of small radius, I could, with the K.B.P's kind approval, do the needful when *Netta* is finished. In 3½-in. gauge she would come out as big as an average 5-in. gauge job. No fully-detailed instructions would be needed, as the machining, fitting, erecting, etc., is all carried out in the manner which I have described umpteen times already, and which regular readers should now know by heart; the whole rigmarole should only take up a few instalments. A corresponding type of locomotive for owners of 5-in. gauge lines, would be a British Railways standard "Class 3" 2-6-2 tank.

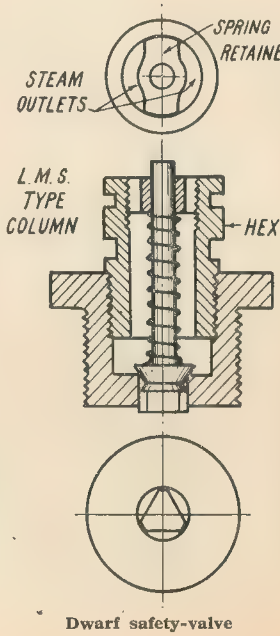
Safety-valves and Blast Nozzles

Several readers have commented on a curious case of inconsistency in a recent article by another writer, who described a safety-valve with a thin screwed disc for spring adjustment; the reason given for the latter was, that a hole in a thin plate will offer less resistance to the passage of steam, than a piece of pipe with a bore of the same diameter as the before-mentioned hole. This is, of course, quite correct, and is an elementary fact well known to all builders of small locomotives. Incidentally, the extra plug shown above the screwed disc, at the top of the valve, serves no purpose at all, and could have been omitted, leaving more room still for steam to escape. Later on, in the same article, a blast nozzle is shown with a feature entirely contradicting the principle mentioned above, as it contains a long parallel hole which would tend to throttle the free exit of exhaust steam, and increase back pressure. Right away back in the early days, Billy Murdock and Tim Hackworth knew all about how to get a sharp blast with the minimum of back pressure, by *contracting the nozzle only*. Since then, every locomotive engineer has followed suit, and all your humble servant's blast nozzles have been arranged on the same principle. Here are two sketches showing how safety-valves can be arranged to suit the wishes of those who object to a column or pillar which is over "scale" size. Both provide ample valve area, plenty of room for escape of steam, and give a more reliable means of adjustment than that afforded by a thin screwed disc, which has only about two threads (if that much!) to withstand boiler pressure. The illustrations are self-explanatory, and dimensions can be arranged to suit any size of boiler. In the first, the column and the screwed base are in one piece. The valve seating is separate, and screwed into the underside of the base. The adjusting plug at the top, can be slotted, or filed away at each side, as shown in plan; and while affording plenty of support for taking the thrust of the spring, still leaves bags of room for steam to escape.

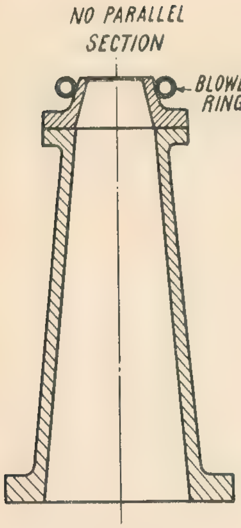
The second valve is on the same principle, but the construction is different. The screwed base which fits the boiler bush, is bored out to form the valve seating; the column is separate, and screwed into it. The same sort of screwed plug can be fitted. The question as to whether the latter projects beyond the top of the valve, is merely a matter of adjusting the length of the spring; personally, I don't care a continental whether it does or not, as long as the safety-valve performs in the manner usually observed by all members of the Honourable Guild of Pressure Relievers, and doesn't conspire to start me on an impromptu journey to the moon.

Now regarding blast nozzles, here are two more illustrations showing sections of blastpipes and nozzles as fitted to full-sized locomotives, ancient and modern. I should know the Brighton specimen well enough, having grazed my knuckles against this kind more than once, when sweeping tubes with a long steel rod with a "lion's tail" of flax in the end. The blastpipe itself was a casting, square in section, and the cap was also square, with a round hole in it, and was attached to the casting by bolts at the corners. The cubic capacity of the pipe was sufficient to prevent back pressure, and the length of the orifice was exceedingly short, for the same reason.

Jumping across the years, the other illustration shows a section of the blastpipe fitted to the full-sized *Britannia* class engines of British Railways. This merchant is coned, and the cap forms a continuation of the cone. An annular passageway is formed in the cap or nozzle; and instead of plain holes, four little nozzles are screwed into it, these nozzles *exactly resembling the type of blower nozzle which I specify for engines too small to use the combined blast-and-blower gadget*. Now if readers will just compare the blastpipe caps which I specified for 3½-in. and 5-in. *Netta*, with the full-size one shown here, they will see the family resemblance; and what is good enough for the experienced full-size locomotive engineers who designed *Britannia*, is good enough for your humble servant. It would be just impertinent presumption to insinuate that such design was all wrong, and try to "improve" on it. I use a straight blastpipe made from tube, for ease of construction in the small engines, but it is of ample diameter—*very* important that!—and the blast nozzle has the sharp internal taper, *and the exceedingly short parallel section*, which gives the required velocity to the escaping steam, without in the least choking it. As I find, from experimenting, that plain holes in the annular passage give as good result as weeny nozzles, in the small size, I specify and use them. I should most certainly NOT use nicks around the nozzle, for blower jets, for the simple reason that when the lubricator is working properly, the exhaust is slightly oily, and the blast nozzle becomes oily too. It wouldn't



Dwarf safety-valve



L.B. & S.C.R. blastpipe

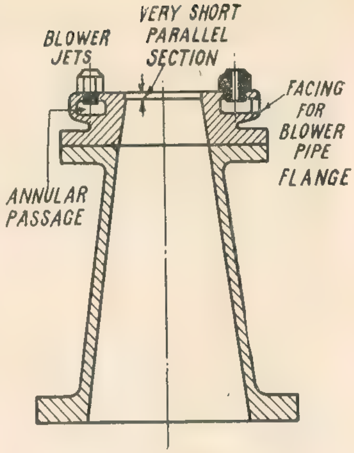
be long before sufficient would accumulate around the projecting bit of nozzle, to mix with the smokebox residue and block up the nicks. This doesn't happen with the holes, which are away from the base of the outer cone ; and even if it did, the trouble could be entirely eliminated by fitting tiny projecting nozzles like those on the big engines. I forgot to mention that both plain ring blowers, like gas rings, and annular passages with plain drilled holes, were used on the old L.B. & S.C.R., and we never had the least trouble with either.

A Literal "Molar Foundryman"

The following anecdote is, I should imagine, unique, and is a striking example of the truth of the old saying that "there's many a true word spoken in jest." Some little time ago, my lower dental set broke right across the middle. Unfortunately for me, the old dental surgeon who had attended to my requirements over the years, had retired, and I was shy to go to another one; but among my host of correspondents there are several who follow the same profession, and two or three had offered to undertake anything that I needed in that line, so I sent the broken set to one of them. He did the needful, and returned them on the second day; they fitted perfectly. When thanking him, I mentioned in jest, that if they broke again, I would send them to Wilwau, and get him to use them as a pattern for a cast-iron set, which wouldn't break.

You can judge of my amazement when my friend replied that I had spoken out of turn, *as it had actually been done* ! His uncle had run a small foundry in Manchester which specialised in precision work. One of the foundrymen had noticed that when he had visited his dentist to get his set repaired, the dentist stuck the broken parts together with sealing-wax and tried them in place, before carrying out the repair. When the set broke again, he did the same, and then used it as a pattern, and made replicas of both top and bottom sets in cast-iron. When polished, they fitted perfectly, and were such a success that he wore them right to the time of his demise; and when interred, they were left in his mouth. Truth was ever stranger than fiction !

Incidentally, I subsequently did a bit of dentistry myself. My last three remaining natural teeth became too loose to be comfortable, so I extracted them—an easy job, as I had carefully noted what the old retired craftsman did when extracting—waited a fortnight to let the sockets set, then took an impression, and sent it with the denture, to the friend mentioned above, with a request to fit new falsies in the gaps where the natural teeth had been. He was tickled to death, did the job, congratulated me on my 'prentice effort, and said that it was about time I joined the union and put up my brass-plate on the garden gate ! !



"Britannia" blastpipe

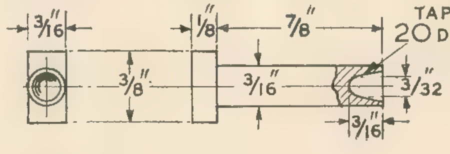
A 10 c.c. GENERAL-PURPOSE ENGINE

(*Continued from page* 453)

by which the component is secured in position; it can, of course, be used as a jig for the tapping holes in the crankcase.

Tappets

Either round or rectangular steel bar can be used for these, and they can be turned all over at one setting and parted off, the sides of the head then being either filed or machined so that they will slide freely in contact with the centre tongue of the guide ; the reason



TAPPETS 2 OFF M.S. C.H.

for this is simply to prevent both tappets turning, and thus ensure that the long side of the head is kept square with the camshaft axis. The shank of the tappet should be dead parallel, smooth, and a good fit in the guide ; the head should be faced off dead flat, and after case-hardening, these surfaces should be highly polished, particularly the latter. But the term "polish" should not be taken to mean just a superficial glitter on a rough or inaccurate surface ; if any doubt exists on this matter, use a lap, as previously described, to generate a true surface before polishing.

In the case of tappet heads, the best method of lapping is to run the tappet in the lathe at medium speed, and with a flat drill pad in the back centre, use this to apply gentle pressure to a flat glass or metal lapping plate, which is charged with fine abrasive and *kept moving* sideways all the time it is in action ; a stationary lap will not produce a flat surface. When properly lapped and polished, the surface should reflect light like a mirror, and not show rings or waves when viewed obliquely. Some constructors may think these fine distinctions unnecessary, and it is quite true that engines will run—perhaps well enough for their required purposes—when they are not observed ; but they *do* make a difference—if you don't believe me, ask anyone who has had experience in building or tuning engines for racing cars or motor-cycles.

The amount of space which I devote to describing small details has occasionally been criticised, but I would assure readers that the demand among inexperienced constructors (for whose benefit these articles are primarily intended) is always for more and more detailed information on methods and processes. Even when some of these have been described several times before, new readers who cannot obtain access to previous issues clamour loudly for their repetition, so that in the circumstances, I make no apologies for my emphasis on "the little things that mean so much."

(*To be continued*)

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:
(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Boiler for Twin Engine

As an exercise for fourth year students in a technical school, it is proposed to construct a small steam engine, such as the Stuart 10 H, and when this is built, it is proposed to produce a boiler to suit it. Can you advise me of a suitable design for a boiler which is within the capacity of a class of students?

R.E.G. (Bristol).

We suggest that the "Trident" boiler would be suitable for this purpose. Drawings for this boiler are obtainable from our Publishing Department, price 5s. 6d. (Ref. No. M.10).

The size of this boiler, however, is rather greater than is necessary for the particular engine, and a smaller boiler known as the "Trident Mark II" has been designed, though no separate detailed drawings of this boiler at present exist. It would, however, be a fairly easy matter to scale down the "Trident" Mark I boiler to about two-thirds of its size.

The "Trident" boilers are designed so as to require the minimum of work in brazing or silver-soldering, and the entire boiler assembly can be made up before inserting it in the outer shell, which is not subject to extremely high temperature and, therefore, does not necessarily have to be brazed.

A detailed constructional article on the "Trident" boilers appeared in the issue of THE MODEL ENGINEER dated May 13th, 1954.

Vienna Regulator Clock

Can you please give me any information regarding the well-known Vienna regulator clock, a series of articles on which appeared in THE MODEL ENGINEER *some years before the war.*

I understand that this clock was not fitted with any striking gear, but I have been offered a striking clock which is said to be a Vienna regulator, and I have been informed that it is unlikely that any non-striking clocks of this type were made.

L.A.W. (Purley).

The original purpose of regulator clocks of any type was to provide a fairly accurate time-keeper for the purpose of regulating other clocks, such as might be needed by a working clock-maker in the course of his work.

In many cases, the advantage of striking gear was considered to be either unnecessary or liable to introduce a risk of affecting the time-keeping properties; but the later and more elaborate examples of regulators were often fitted with striking trains without any apparent ill effects. Your description of this particular clock appears to correspond in general with the design of the Vienna regulator.

Clock Construction

Can you please advise me where to obtain any information on the construction of a rolling ball (Congreve) clock, and also a Eureka electric clock?

L.G.M. (Sandwich).

An article on the Congreve clock was published on January 3rd, 1946, and continued through eleven subsequent issues. The Eureka clock was dealt with in the following issues: February 3rd, 17th, March 3rd, 17th and 31st, 1949. Articles also appeared on a Semi-Free Balance Clock, by S. J. Wise, in the issues of THE MODEL ENGINEER dated November 10th, 17th and 24th, and December 1st, 1949.

Dimensions of Beam Engine

I should like to build the simple beam engine recently described in THE MODEL ENGINEER, *but before doing so, I should be glad if you could advise me of the major dimensions of this engine, as this would be a great help in planning suitable foundations, flooring, etc. The main dimensions required are the height of the standards and the length of the beam, also minimum dimensions of the base plate.*

A.L.C. (Sudbury).

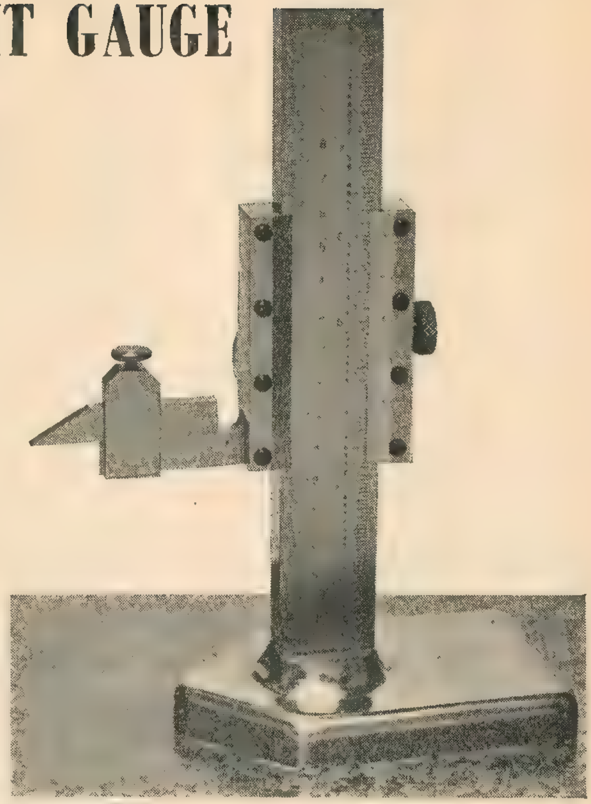
The height of the standards is 6½ in. from the floor to the bearing seating and the beam is 7½ in. between the centres of the end pivots. The minimum size of base plate is 10¼ in. by 5⅛ in.

Waiting for the Parade?

THE two traction engines seen in the photograph reproduced on this page appear to be waiting for their drivers, prior to taking part in the "grand parade" that usually initiates the programme at a rally. The photograph was taken at a fete held, last year, at Farnborough, Hants, and organised by the Railway Enthusiasts Club; Mr. R. W. Barnard was the "man behind the camera," and he certainly seems to be able to appreciate an opportunity when it presents itself. To him, as well as to Mr. E. J. Baughen, of the Malden Model Engineering Club, we are indebted for this rather unusual little story.

The identity of the two engines has already somewhat puzzled a few people to whom we have shown the photograph; but on page 461 readers will find the explanation revealed in a second photograph. Here, three engines are seen, standing side by side, and progressively increasing in size from the smallest to the largest. Reading from the left, the first and second are, respectively, a 1-in. and a 1½-in. scale engines built by Mr. H. Barnes, of the Malden club, to designs published in THE MODEL ENGINEER; the third is Mr. E. J. Baughen's 2-in. scale free-lance engine which will be remembered by many readers for the yeoman service it performed at last year's "Model Engineer" Exhibition.

A NEW VERNIER HEIGHT GAUGE


The Grey & Rushton height gauge (only the lower part of beam is shown)

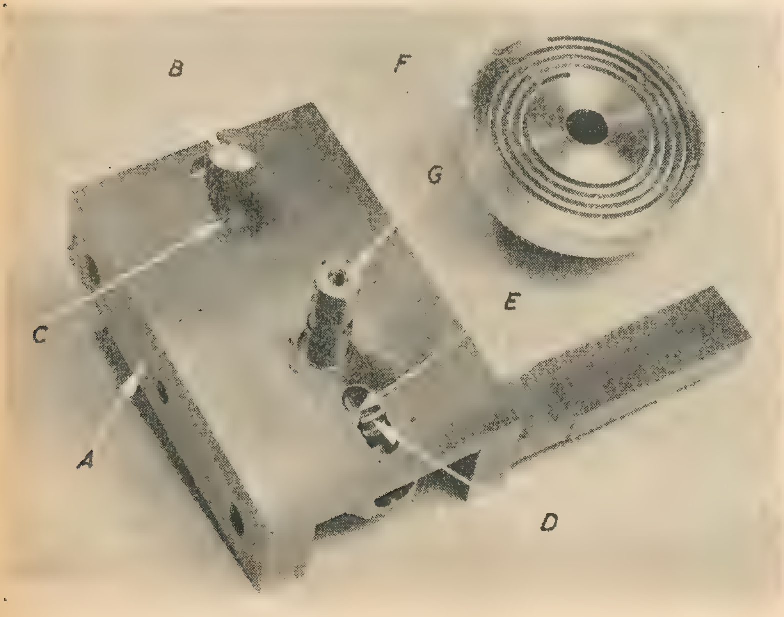
MESSRS. Grey and Rushton (Precision Tools) Ltd., 93, Far Gosford Street, Coventry, have submitted for our inspection their latest height gauge, which incorporates a very ingenious device for facile and accurate setting of the sliding head. This is an exclusive patented feature, known as the "Rotomatic" movement, and is a great improvement on the vertical fine adjustment-screw normally fitted to this type of instrument.

The main sliding head *A*, which fits over the outside edges of the channel-section beam, and can be locked by a knurled screw at the side, pressing on a compensated gib strip, contains a subsidiary slide (not visible in the photographs) which fits inside the channel, and can be locked thereto by means of a conical drawbolt, acting simultaneously on two small plungers, by pressing them outwards to grip the inside edges. The drawbolt is operated by a knurled nut *B* which projects through a slot *C*, in the main slide, and a small tongue *D* carried by the inner sliding member projects through a second slot *E* at the other end of the slide. This engages in the groove of a scroll cut in the inner face of the large-diameter knurled drum *F*, which works on the fixed pivot stud *G*, so that rotation of the latter produces relative endwise movement between the two slides.

To obtain fine adjustment of the sliding head, the side screw of the latter is first loosened, and, after setting it roughly to the required height, the inner slide is clamped by means of the knurled nut. A limited amount of movement can then be obtained by means of the drum, enabling the head to be set exactly to the vernier scale reading, or to a standard gauge or comparator. The movement is extremely smooth, and when the head is locked by the side screw, no deviation of the position of the finger can be detected.

The beam is graduated in English and metric measurements, in 1/20 of-an-inch and 1 mm. respectively, and will read with the aid of the vernier to 1/1000 in. and 1/50 mm. The finger, which is machined as an integral part of the sliding head, is 0.400 in. thick and can be used for contact measurements to upper or underside surfaces, also for marking-out by using the scriber blade and clamp provided. All components are machined from solid carbon-steel, and ground after heat-treatment, the base being hardened and lapped, and having a large area of wearing surface, with sufficient weight to ensure stability. Workmanship and finish are of a high order throughout, including the engraving of the scales, for which specially-designed dividing machines are employed. We are informed that this height gauge is already in great demand in tool rooms and inspection departments of precision engineering industries.

Readers of this journal may be interested to learn that the managing director of the above firm, Mr. V. E. Grey, is a keen model engineer, and was a pioneer in the development of petrol-driven model power boats; in recent years, he has become interested in radio control, and is an active member of the Coventry Society of Model Engineers.



Details of the Rotomatic head. A—main slide; B—locking-nut; C—slot; D—tongue on inner slide; E—slot; F—scroll in adjusting drum; G—pivot stud

READERS' LETTERS

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

MR. TED VANNER, A TRIBUTE

DEAR SIR,—The Kent M.E.S. has recently suffered a grievous loss by the decease of Mr. E. Vanner who, as all readers of THE MODEL ENGINEER will know, was for a great number of years a leading figure in the model power-boat world. He had for some years taken a leading interest in the affairs of the society, and although primarily interested in boats of all types never failed to offer his assistance and advice to any member with any problem. His passing has been a great blow to all his friends, and his cheerful countenance and greeting will be missed by all who had the pleasure of knowing him.

Yours faithfully,

London, S.E.6. F. H. GRAY.

IN DEFENCE OF STEAM

DEAR SIR,—In the issue of THE MODEL ENGINEER for March 10th, I noticed in "Smoke Rings" the first doubts I have yet read regarding the proposed electrification of British Railways.

Now in 55 years of life I have learnt long ago that you must not stand in the way of progress. You are behind the times, old-fashioned, stupid, ill informed, past it, won't face up to facts and the inevitable, and so on. I have also found out that quite a lot of progress in my time has been a very mixed blessing, viz. the submarine, the bomber with its diabolical cargo of destruction. So why not look a little more closely into this question of the electrification of the railways?

I've a shrewd suspicion that this can turn out to be a mixed blessing also. To suggest that we shall benefit financially I should say is highly improbable. Again, where are the miners coming from to hew out all the coal for all the extra power produced in the kind of plants we have and are still building?

We are supposed to be going to save 15,000,000 tons of coal a year, but we shall want a *lot* more than that. The electrical industry is a comparatively new one, and has made great strides in a short time; but at the same time, it has managed to get itself into about the biggest incomprehensible muddle imaginable. Most industries are a mystery to those who are not engaged in them, but the electrical industry seems to be a mystery to *everyone*; at least, that is how I find it in various dealings with the Board's multiplicity of officials.

You go into a certain store and buy a plug or something, only to find it does not fit as it should when you get it home, and are told you should get so and so from Messrs. Blank & Blank; so you pay twice the price for the same article that still does not fit!

Have you ever seen the antics some of our practical engineers have to resort to, to assemble some of the heavy types of apparatus? Nearly standing on their heads, and Oh! the language! The whole world is littered up with all kinds of apparatus that won't work here now, because so and so or the Supply Co. have changed from this to that. The electrical industry seems to go through a *series* of *phases* of *negative* nonsense with nothing *positive* until you get hold of both ends and then it darn well does its best to kill, which is adding insult to injury without *parallel*.

Now what about the awful old steam locomotive, with its so terribly low efficiency? At least, that is what the brainy ones say. After having run for about 40 years with precious little being done to it, year in, year out, with blowing valves, leaky cylinders, valve-gear worn out, kicked, abused, never cleaned, a stinking, filthy abortion, literally dropping to pieces, she arrives in time and goes off again. No one knows why, or cares!

During the first lot of snow we had this year, I was at Cobham, and reached the station there about 4-15, by which time about 3 in. of snow had fallen. I arrived at Waterloo at 7-15, and watched quite a few steamers go by; 19 miles of misery! Well, we are going to have our electric trains everywhere now; in some places, they are an absolute necessity, but what of their efficiency? If you work for a boss, the only efficiency he understands is how much money you make for him, and the electric locomotive won't do that! But you will save a little smoke from coming from thousands of little chimneys, only to puff far more smoke out of a few large chimneys.

Steam through the years, has served man well, and can still go on serving him, if you let it. It has been a blessing to him, and one would be hard put to it, to find out any ill results to humanity since James Watt blew the lid off the kettle and Hero of Alexandria opened his palace doors with it.

Good-bye, old Puff Puff! I'm sorry you are going to please the boffins of industry. I shall not be around to say "I told you so," when the cry of consternation goes up; but, no doubt you will be saddled with an even more expensive millstone by then, the diesel-electric.

Yours faithfully,

"SEMPER FIDELIS"

ELECTRIC MUFFLE FURNACES

DEAR SIR,—I have read with interest the letter from your correspondent, J. E. of King's Lynn, in THE MODEL ENGINEER of February 24th. Re. the cracking of the muffle in his electric furnace.

Having decided to make a similar furnace, I wrote the firm suggested, for a quotation, which I duly received. In addition, they pointed out first to ensure that the muffle was not lightly clamped, as this would almost certainly result in breakage due to expansion. They also stated they were not in favour of covering the electrical winding with the additional fireclay investment mentioned in the article by "Duplex," the "alumina" cement which they supply being sufficient. The use of fireclay cement such as Pyruma, bonded with sodium silicate, will only tend to produce a compression force in the muffle which might easily crack it.

I may state I have not yet made up the furnace, as I am awaiting delivery of the muffle. I intend to observe the maker's recommendations, and mention them in the hope they may be the answer to your correspondent's difficulty.

Yours faithfully,

Stillorgan. L. G. MCGILL.

LOCO BLAST PIPES

DEAR SIR,—With reference to the letter on blast pipes and coal, sharper cutting blast can be obtained simply by bricking or building up inside of smokebox. In other words, blast can be made adjustable, regardless of what type blast pipe is used.

Yours faithfully,

Southall. W. C. T.

Next Week . . .

NOTABLE MODEL I.C. ENGINES

P. G. F. Chinn describes the Cameron "09" Marine Special.

FOR THE NOVICE

Fitting up a drilling attachment to the lathe cross-slide, by "Duplex."

EXHIBITION REPORT

"Northerner" concludes his review of the Northern Models Exhibition, Manchester, and illustrates several of the outstanding exhibits.

WORKSHOP PHOTOGRAPHY

Practical advice on how to get the best results in this highly specialised department of photographic work, by a contributor whose pictures often appear in "The Model Engineer."

"TWIN SISTERS"

The description of the details of this engine, is brought to a conclusion.

"NETTA"

We come now to the boiler for the largest of the five "editions" of this engine.

WITH THE CLUBS

The Society of Model & Experimental Engineers

On Thursday April 21st, at 7.0 p.m., a meeting of the society will be held at Caxton Hall, Westminster. Mr. L. H. Sparey, the well-known author of "The Amateur's Lathe" and other works, will address the society on "My Most Useful Workshop Gadgets" (an excellent opportunity to learn how to make the utmost use of limited equipment).

Members are reminded that the few Thursday meetings have been arranged to meet the needs of those who find Saturday meetings inconvenient. A cordial invitation to attend the above meeting is extended to visitors; they are asked to make themselves known to the secretary who will be pleased to arrange a visit to the society's well-equipped headquarters.

Hon. Secretary: S. L. SHEPPARD, Third Floor, 11, Portland Place, W.1.

Stephenson Locomotive Society

By co-operation with British Railways and other authorities including the granting of generous facilities, the society has again arranged an extensive programme covering considerable areas of England, Scotland and Wales throughout spring, summer and autumn, including visits to locomotive works, running sheds, collieries and other industrial undertakings possessing railway installations, certain important signal boxes and other centres of railway interest. There will be week-end tours, lineside locomotive and traffic observations, also more of the ever popular special train tours over lines not normally available to passengers.

The S.L.S. Midland Area has planned the following specials on which visitors will be welcome as far as accommodation permits, and regarding which further particulars will be available in due course: April 23rd, Shropshire Rail Tour from Shrewsbury to Coalport, Minsterley, etc.; May 21st, West Midlands, former G.W.R. branches including Ditton Priors; June 19th, Birmingham and Stratford-on-Avon to Swindon Works hauled by a "Star" 4-6-0, visiting Didcot and Oxford Motive Power Depots on return journey; July 2nd, South Wales (Swansea District); July 17th, Special run on the Vale of Rheidol scenic Light Railway from Aberystwyth—half-day excursions from Birmingham, Manchester and elsewhere in connection.

Many indoor meetings with attractive features are held at eleven centres during the darker months.

General Secretary: H. C. CASSERLEY, Ravensbourne, Berkhamsted, Herts.

Chelmsford S.M.E.

At the A.G.M., the secretary reported a satisfactory year with progress in every section of the society. The officers were re-elected. Plans for the coming season include an exhibition, at which the new "O" gauge track will be shown, and a start on the permanent outdoor 3½ in. and 5 in. track immediately afterwards.

Monthly meetings: Moulsham Grange, Clubroom, Tuesday, April 26th, Mr. G. H. Landon on "The Development of the Small Arm from the Hand Gonne to the Rifle."

Tuesday, May 31st, Mr. J. Banyard on "A Progress Report on the 3½ in. Express Tank Loco."

Exhibition: Wednesday, August 31st, to Saturday, September 3rd. Members of any model club or society in the East Anglia area are invited to enter models for the "East Anglia Challenge Cup" (Model Engineering and Aircraft sections).

Particulars from Hon. Secretary: R. M. KING, 2, Upper Roman Road, Chelmsford, Essex.

Acton S.M.E.

We are now completely installed in our new premises at 29a, Acacia Road, Acton, W.3, off Horn Lane. A successful house-warming and exhibition was held on March 1st. Mr. Maskelyne kindly acted as judge. The "OO"-gauge track layout is almost complete and the machine shop practically ready for operation.

The club room has been redecorated and might almost be described as sumptuous.

The following are planned for the next four months:

Track day at West London Club's track.
Lectures on model locomotive design.
"OO"-gauge night.
Portable track to 9th Ealing Boy Scouts meeting.
Visit to engine room of a ship in survey docks.
Club outing to Romney Hythe & Dymchurch railway.
Visit to Southall railway works.

Meetings are at 7.30 p.m. every Tuesday. All are welcome.

Hon. Secretary: H. WINTON, 112, St. Dunstan's Avenue, Acton, W.3.

The Marlborough S.M.E.E. (N.Z.)

The history of the steam car was the subject of a talk given by Mr. D. C. Thynne when the society resumed its meetings after the summer recess. Mr. Thynne and a brother had, in recent years, owned and run a Stanley steam car, and had acquired a profound knowledge of them during this ownership.

A short commentary on South Island hydro-electric power development schemes and an outline of some of the problems involved in their achievement was given by the president, Mr. E. J. Speight.

Hon. Secretary: J. E. ROBINSON, Scotland Street, Picton, New Zealand.

THE MODEL ENGINEER DIARY

April 21st, 22nd and 23rd.—Stockport and District Society of Model Engineers.—Exhibition of models at the Lads' Club, Wellington Street, Stockport. Open on Saturday 10.0 a.m. to 9.0 p.m. Thursday and Friday 6.0 p.m. to 9.0 p.m.

April 23rd, May 14th, 28th, 30th, June 11th and 25th.—Bristol Society of Model and Experimental Engineers.—Public days at the track, Canford Park.

April 30th.—Croydon Society of Model Engineers.—Exhibition of models at the showrooms of Alban Crofts, Coachbuilders, Brighton Road, South Croydon, Surrey. Opening time—2 p.m.

May 6th and 7th.—Crewe Model Engineering Society.—Exhibition of models in The Corn Exchange, Crewe.

May 22nd.—Forest Gate Model Power Boat and Engineering Society Regatta at Victoria Park, Hackney, London, E.9. Starting at 11.0 a.m.

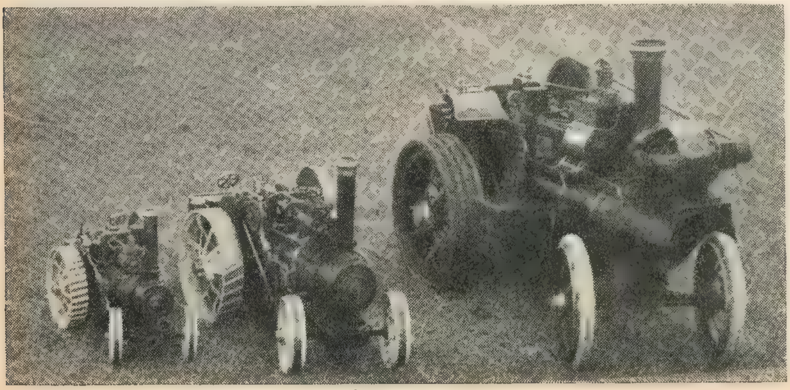
May 28th.—Welling & District Model Engineering Society Regatta at the Belvedere Recreation Ground. Starting at 2.30 p.m.

May 30th.—Bournville M.Y. & P.B.C.—Regatta at the Valley Pool, Bournville Lane, Birmingham. Starting at 11.30 a.m.

June 11th and 12th. — Birmingham Society of Model Engineers.—Annual National Rally of Steam Locomotives at the track at Campbell Green, 87, Horse Shoes Lane, Sheldon, Birmingham.

June 25th and 26th.—The West Riding Small Locomotive Society.—Rally of Model Locomotives, Gauges 2½ in. to 7¼ in., at Blackgates House, Bradford House, Tingley, Wakefield. Open from 10 a.m. to 10 p.m., both days.

August 17th, 18th, 19th, 20th, 22nd, 24th, 25th, 26th and 27th.—The Model Engineer Exhibition, in the New Horticultural Hall, Greycoat Street, Westminster, S.W.1. Open from 11 a.m. to 9.0 p.m



Correction

In the advertisement by Messrs. J. & H. Smith Ltd., Harrison Street, Leeds, for the Senior Slik-Saw, in the issue of THE MODEL ENGINEER dated March 10th, the price was quoted as £46 10s. 0d. We are now informed by our advertisers that this was a clerical error, and the correct price is £44 10s. 0d.

CORRESPONDENCE

The Managing Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Correspondence and manuscripts should not be addressed to individuals, but to the Managing Editor, THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Private: 3d. per word. Trade: 6d. per word. Minimum 12 words. Use of box 1s. 0d. extra.

THE MODEL ENGINEER

Rates for displayed advertising in this section 35s. per single column inch $1\frac{7}{8}$ inch wide.

CLASSIFIED ADVERTISEMENTS

The Advertisement Manager reserves the right to refuse or suspend advertisements without giving any reason. No definite date of insertion can be guaranteed. Every care is taken to avoid mistakes, but the publishers cannot be held liable in any way for printing errors or omissions. Receipt of "copy" for publication implies acceptance of these conditions by the advertiser. Whilst every care is taken to exclude advertisements from doubtful sources, no responsibility can be accepted by the publishers for the bona fides of advertisers.

WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

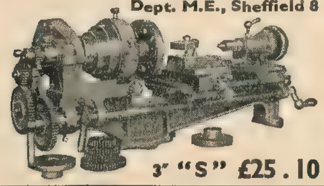
The Acorn Machine Tool Co. (1936) Ltd. are in a position to undertake the complete rebuilding of Atlas, Acorntools, Sphere and Halifax lathes, or if preferred, we can supply any spare parts that may be required for these machines. Full range of accessories and equipment for all these machines also available. Generous allowance given on old machines against the supply of new "Acorn" lathes. Second-hand machines of Atlas and Acorntools manufacture, rebuilt by us available from £75 each. Write to—610-614, Chiswick High Road, W.4. Tel.: Chiswick 3416-7-8-9.

Unrivalled in its Class. The E.W. $2\frac{1}{2}$" × 10" lathe. Model "A" plain lathe £13 4s. 0d. Fully convertible to back gear and screwcutting. Can be obtained from 5s. weekly. No interest no fuss credit terms. Details s.a.e.—WANSTEAD SUPPLY CO., 48, High Street, London, E.11.

G. P. Potts, Ruthin Road, Denbigh. Milling, grinding, saw table attachments, turrets, also castings, drill grinding jigs, collets, B.A. screws, bolts and nuts. Lists 6d.

Rebuilt Lathes. The Acorn Machine Tool Co. (1936) Ltd. offer rebuild to limits "Acorntools" and "Atlas" 10" swing s.s. available. Write—610-614, Chiswick High Road, W.4. (Phone: CHI 3416.)

CHARLES PORTASS & SON
Contract Surplus **Buttermere Works, Dept. M.E., Sheffield 8**



3" "S" £25 . 10

Tool Bargains. High speed drills up to $\frac{3}{8}$" 12s. 6d. doz. p. & p. 6d. Handrills $\frac{1}{4}$" cap. by Millers Falls U.S.A., 12s. 6d., p. & p. 1s. 3d. Needle files ass. 12s. doz. Slitting saws, H.S.S. $2\frac{1}{2}$" to 3" various thickness three for 10s. Thread chasers 40 to 11 thread, 2s. each. High speed drills up to tapping $\frac{1}{4}$", 7s. 6d. doz. Bargain lists 6d.—MIBRO EQUIPMENTS LTD., 81, Derby Road, Nottingham.

High Speed Sensitive Power Bench Drilling Machine. Chuck capacity $\frac{3}{8}$", £6 10s. or credit terms 2s. 6d. weekly. Send s.a.e. for descriptive pamphlet.—WANSTEAD SUPPLY CO., 48, High Street, London, E.11.

MONODEX Regd.

Revolving Centre

The low price plus the smooth running qualities of this centre make it a necessity in every engineer's workshop.
These tools are precision built, each head being matched to fit the parallel of the shank.

No. 1 M.T.S.	37/6
„ 2 „	37/6
„ 3 „	47/6

Obtainable from your local toolshop or sent post paid on receipt of remittance from:— PATENTOOLS LTD. MITRE HOUSE · BRIGHTON

Wanted. Little John Lathe, second-hand but in good condition. Please give age and accessories.—Box No. 7665, MODEL ENGINEER Offices.

Atlas Screwcutting Lathe, 6 in. face-plate, 30 in. bed. Complete on bench with $\frac{1}{4}$ h.p. a.c. motor, all accessories. Excellent condition, £30.—BIDDLE, 4, Sunnymead Road, London N.W.9.

Wanted Lathe and other engineering equipment.—McGAUGHNEY, 51, Mullway, Letchworth, Herts.

Wanted. Myford M.L.7, Super "7" Boxford, or Littlejohn lathe. Cash. Can collect London area.—ADVERTISER, 2, Isabella Road, Homerton, London, E.9.

Wanted Shute Boards and Planes as Stanley numbers 51 and 52.—Box No. 7697, MODEL ENGINEER Offices.

Solid Steel Engineer's Bench ex-Army 3' × 2' with holes for vice, £5.—BEC 6404, 88, Stanhope Grove, Beckenham, Kent.

Holtzapffel Ornamental Lathe, overhead motion rose and epicyclic cutters, electric motor, full range of attachments and tools, £200 for quick sale.—PAYNE, Elm Lodge, Ludlow, Salop.

The "Handyman" Tool Set for the man about the house; 19 useful tools including hammer, saw, plane, oil can, file, pliers, etc., in strong steel tool box. 87s. 6d. cash or 25s. down and 6 monthly payments 12s. each.—WOOD, 30, Dorset Square, London, N.W.1.

Collets for Lathes. No. 1 Morse, $\frac{1}{8}$", 5/32", $\frac{3}{16}$" and draw-bar, £1. Extra sizes $\frac{1}{16}$", 3/32", 7/32", $\frac{1}{4}$", 4s. each. No. 2, three collets and bar, 30s., sizes $\frac{1}{16}$", 3/32", $\frac{1}{8}$" 5/32", $\frac{3}{16}$", 7/32", $\frac{1}{4}$", $\frac{5}{16}$", $\frac{3}{8}$", 5s. each. Guaranteed to half-thou. "Makes turning small parts a pleasure" (customer). State mandrel length. Seen by appointment. Supply is getting low. Postage 1s.—HOOP, 80, Ridgeview Road, London, N.20.

B.O.C. Type C.H. welding and universal cutting plant, complete, little used, £17 10s. delivered.—Box No. 7701, MODEL ENGINEER Offices.

Wolf Cub Kit, cost over £20 will accept, £15.—J. McLAREN, 107, Fraser Avenue, Inverkeithing, Fife.

Myford M.L.7 dividing attachment, absolutely unused, brand new, cost £14, accept £8 10s.—5, Rosehill Way, Newcastle-on-Tyne 5.

Drummond Lathe, very good condition, £27 or near offer.—UPMINSTER 4451.

Pratts Heavy Duty 4" independent chuck, new, £5 5s. Several micrometers, cheap. Stamp, details.—6, Beechgrove, Warmsworth, Doncaster.

Wanted. 5 Pint Blow Lamp in good order, reasonable price.—Box No. 7705, MODEL ENGINEER Offices.

MODELS AND FITTINGS

Passenger-carrying Model Railways for public pleasure. Will owners operating 5" to 15" systems and wishing to dispose of whole or share in business, please communicate.—Box No. 7686, MODEL ENGINEER Offices.

$10\frac{1}{4}$" "Royal Scot" new. Best offer secures, must sell.—Box No. 7683, MODEL ENGINEER Offices.

Wanted. $7\frac{1}{4}$" Gauge passenger cars, bogie units and parts, points. Also model railway or general model business wanted to purchase or share in.—Box No. 7687, MODEL ENGINEER Offices.

Rare Items now available from Cherry's of Richmond including compound marine engines, beam engines, vertical and horizontal engines, traction and showman's engines, passenger-hauling locomotives, boilers, engine driven and showcase model ships, etc. All built to the highest model engineering standards, and at reasonable prices. Send $2\frac{1}{2}$d. stamp for free descriptive list. Also available lists of gauge "O" and gauge "OO" locomotives.—CHERRY'S (SURREY) LTD., 62, Sheen Road, Richmond, Surrey. Telephone RIChmond 2454.

MUSICAL MOVEMENTS !!!
For Cig. Boxes, etc., 17/- each
Also Long Playing Tunes, 25/- each
S.A.E. for Tune List *2/3 days delivery*
Repairs undertaken
M. MOSS
63, Fontwell Pk., Ashford, Middx

Lauson $1\frac{1}{2}$ h.p. Petrol Engines, adjustable governor, light, compact, air-cooled, perfect order, £10, carriage paid.—STAN MORGAN, Snead Mill, Churchstoke, Mont.

Wanted Steam Pump $1\frac{1}{2}$" to 2" bore stroke or similar shuttle or lever valve, sound condition.—WARBURTON, 69, Walsall Road, Darlaston, S. Staffs.

Experimental R/C Wavemaster, E.D. 346 W/C engine differential rudder, hard valve receiver, £15, transmitter £5. Crystal controlled transmitter, £5, sequential control unit, £4. Wavemaster I.R.G.S., £2. Hard chine hull, £3. M/A meter, motors, relays, etc., £6.—HAWES, Limberlost, Welwyn.

For Sale. $3\frac{1}{2}$" Gauge tank locomotive "Molly," engineer built, good steamer, first-class job, £60 o.n.o. Also $3\frac{1}{2}$" gauge 4-6-2 finished chassis, has three cylinders, full Walschaerts piston-valve gear, two water pumps, triple oil pump, runs well on compressed air. Awarded "M.E." Silver Medal. Most material for boiler. What offers.—GODMAN, 8, St. Julians Road, St. Albans.

Take Your Choice! Castings and materials supplied to construct E. T. Westbury's simple beam engine, or his latest 10 c.c. general purpose, four stroke. Stamp for price sheets.—H. HASELGROVE, 1, Queensway, Petts Wood, Kent.

ROGERS 31, NELSON STREET, SOUTHPORT

Compressors. Twin, Cylinder, ex W.D. ready for use. 12 cu. ft., 200 lb. max. Professional type. Full details on request.
Rectifiers 6/12V, 2 amp. ... 8/-
Springs assorted, 50 in box ... 3/-
Adjustable Signal Winkers 6 or 12V 5/6
Compressors ex W.D. 3 cu. ft. 55/-
3" Green Grit Grinding Wheels 4/9
Rectifiers for meters FW ... 3/9
Self Tapping Screws, 100 ass't'd 3/-
Abrasive Discs 5" dia. ass't'd doz. 3/6
Flexible Drives 4' long ½" dia. ... 8/6
Admiralty Rotary Compressor Plants complete less motor £5.7.6
Empire Tape 4" wide, 300' ... 7/6

May we send our list of hundreds of interesting items? 1½d. stamp please.

Injectors for 3½"-g. or 5"-g., 25s. each. Steam valves 4s. 6d. each All new. Mechanical water pumps 27s. 6d. each.—J. TAYLOR, 10, Bainton Grove, Woodmansey, near Beverley, E. Yorks.

"Gerry" 0-6-0 G.E.R. tank locomotive in gauge "O." Blueprints 10s., wheel castings, 3s. 3d. set, cylinder castings, 5s., boiler materials, 4s., 6d. for list.—LUKEN'S-o'-B'ham, 10, Coldbath Rd., Birmingham, 14.

ELECTRICAL

A.C. Motors, Delco Capacitor, start induction, 200/250 V, 50 cycles, 1 phase, 1,425 r.p.m., ¼ h.p., £3 12s. 6d.; 1/3 h.p. £4 17s. 6d., ½ h.p., £6 10s. 0d. Perfect and guaranteed. Passenger carriage, 5s.—JOHNSON ENGINEERING COMPANY, 319, Kennington Road, S.E.11. Reliance 1412/3.

House Service Meters, 220/250 V, (a.c. or d.c.). Credit or prepayment type.—UNIVERSAL ELECTRIC CO., 220, City Road, London, E.C.1.

Brand New Motors. English Electric Co. ¼ h.p., 230/250 volts, 1-phase, 1,425 r.p.m. £5 5s. 0d. 1/3 h.p. ditto, £6 5s. 0d. New d.c. motors, C/Parkinson ¼ h.p., 210-250 volts, 1,435 r.p.m., £5 10s. 0d. 1/3 h.p. ditto, £6 10s. 0d., ½ h.p., £7 10s. 0d. New M.E.M. starters ¼-½ h.p., 19s. 6d. ¾-1 h.p. 60s. Reversing switches (machine fitting), 24s. 6d. G.E.C. transformers, 230 volts to 25 volts, 6 amps, £4 10s. 0d. ditto, 230 volts to 17/35 volts, 8 amps, £4 15s. 0d. Foster auto-trans, 220/240 to 110/120 volts 2 kVA, £10. Some others ditto, £5. Exchanges. Purchases.—VERNON SMITH LTD., 364/366, King Street, London, W.6. RIV 3964.

SITUATIONS

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

Engineering Capacity Required. Firms or individuals with own plant, required part or whole time, for tool making, jig boring, models, patterns, turning, milling, grinding, fabrication, sheet metal work, etc. State condition plant, age and range with rate per hour to—MOBEX ENGINEERS, Chertsey.

Skilled Mechanic Required by Midland instrument makers. Experience in instrument making not essential, but should be capable of turning, milling and fitting to close limits. Pensionable employment with good bonuses, giving income of £10 to £15 per week.—Box No. 7704, MODEL ENGINEER Offices.

Fitter-Turner Improver wanted for model and light engineering work.—Below

Counterhand wanted for retail model and tool department. Permanent jobs and good wages.—BOND'S LTD., 357, Euston Road, London, N.W.1.

GENERAL

"Spraying Handbook" 1950 ed. Car, caravan, industrial, domestic stoving, flock leather spraying, 3s. 6d. post free.—LEONARD BROOKS, 25, Harold Wood, Romford.

Compressor Equipment, miscellaneous items, etc., catalogues, 1½d.—PRYCE, 157, Malden Road, Cheam.

Guaranteed! Easy Home Constructed Refrigeration. Genuine domestic components. Not second-hand ice cream scrap. Modern hermetic G.E.C. units. Gas, electric and oil silent units. Everything for refrigeration. Complete specialists. Send s.a.e. for free illustrated "Sealed-System" leaflet or 1s. for complete catalogue (refunded with first order).—BRAID BROS., 50, Birchwood Avenue, Hackbridge, Surrey. Phone: Wallington 9309.

Watch and Clock Lathes, cleaning machines, staking tools, etc. (Large illustrated catalogue, 1s. 6d. p.p. price list 1s. 1d. p.p.). Stop watch and chronograph repairs and materials for the trade. Special offer. New (slightly soiled) 2½" Burnerd 3-jaw (reversibie) scroll chucks, £3 11s. 9d. post paid. (Used 6, 6½, 8 and 10 mm. lathes bought, sold and part exchanged.) Easy payment terms available.—JOHN MORRIS (CLERKENWELL) LTD., 64, Clerkenwell Road, London, E.C.1.

DUPLEX MOTORS

SEE "M.E." 10-2-55

Series Wound. 0.3 to 0.6 h.p., 5U/2365/6/7/8. As Fig. 1. Slightly knocked about but tested and very good runners, **£1** each. A few as new, **27/6** each. Post paid.

Compound Wound. 1/3 h.p., 5U/4065. As Fig. 4. New and boxed, **£1** each. Post paid

Shunt Wound. American Delco, as Fig. 10. **12/6** each. Plus 1/1 post.

K. R. WHISTON
New Mills, Stockport

Compressors for Sale. Twin pistons complete with air receiver, driving wheel and motor cradle, 180 lb., 2½ cu. ft., price, £3. Also 8 cu. ft. compressor only, £5. Motors a.c. and d.c. all types, ¼ h.p., £3. Carriage forward.—WHEELHOUSE, 1, The Grove, Isleworth, Middx. Phone, Hounslow 7558.

Air Compressor Units, 2½ to 18 cu. ft., 100 to 800 p.s.i. from £4 17s. 6d. Stationary and mobile plants from £16 17s. 6d.—Below.

Air Tanks and Accessories at approximately 50 per cent. off lists.—Below.

TV Generators and Lighting Sets "Chorehorse" BD-12-A, £47 10s. 0d. "Onan" relays starting from £37 10s. 0d. "Homelite" £35 0s. 0d., etc., all with d.c. output. Straight d.c. lighting sets "Delco" £16 10s. 0d. Johnson "Chorehorse," £25. "Homelite" 24 V, 2,000 watts, £27 10s. 0d. —TEDDINGTON ENGINEERING CO. LTD., Dept. G. 29/31, High Street, Teddington, Middx. KINgston 1193.

Build Your Own Refrigerator. All components available at reasonable prices Frigidaire "Flowing Cold," units, £5; small single-cylinder units. Kelvinator, etc., £4; ¼ h.p. heavy duty motors, £3. Chrome cabinet fittings new, £1 set. Money back guarantee. S.A.E. for lists and schematic diagram.—WHEELHOUSE, 1, The Grove, Isleworth, Middx. Hounslow 7558.

Gear Pump. A really fine ex-aircraft gear pump. Suitable for lathe coolant or for oil. Approx. ⅜" bore delivery, 30s. each. Carriage paid. Also nuts, bolts and other interesting items. S.A.E. for list.—HULSE & GODDARD, Buxworth, Stockport.

Bumble Bee & Busy Bee, 50 c.c. auxiliary engines by Edgar T. Westbury. Send s.a.e. for lists for our super castings and all accessories for these engines.—BRAID BROS., 50, Birchwood Avenue, Hackbridge, Surrey. Telephone: Wallington 9309.

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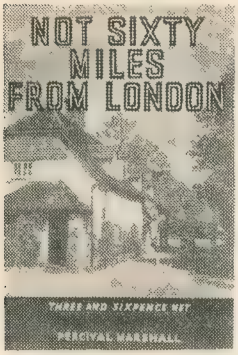

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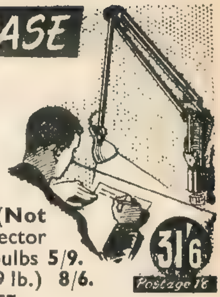

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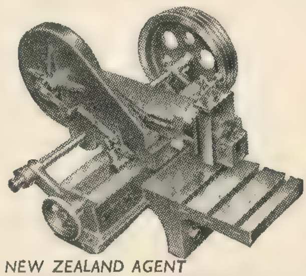

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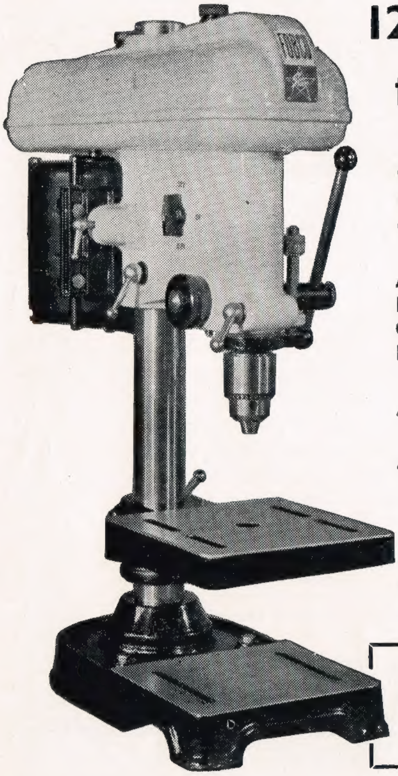

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